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THE
ARTILLERIST'S HAND-BOOK
OF
REFERENCE.

**A. KING AND COMPANY, TYPE MUSIC, CLASSICAL AND GENERAL
PRINTERS, UPPERKIRKGATE, ABERDEEN.**

THE
Artillerist's Hand-Book of Reference:

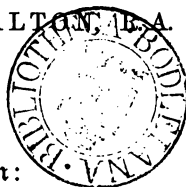
ALPHABETICALLY ARRANGED
IN THE FORM OF
QUESTIONS AND ANSWERS
ON
ARTILLERY, MILITARY LAW, INTERIOR ECONOMY,
AND
MISCELLANEOUS SUBJECTS:

A Guide to the Examinations for Promotion,

AND
A HAND-BOOK OF REFERENCE,
FOR THE USE OF
THE ROYAL AND RESERVE ARTILLERY.

BY
LIEUT. GEORGE WILL, R.A.,

AND
LIEUT. J. C. DALTON, R.A.



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1876.

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P R E F A C E.

THE object with which this Work was originally undertaken was to supply a want which has long been felt, namely, a Guide to the Examinations for Promotion from Lieutenant to Captain in the Royal Artillery. This object has now been combined with the provision, on a limited scale, of a Hand-book of Reference for the use of all artillerymen.

The compilers believe that this volume will afford a compendium of professional information, which will enable an officer, by refreshing his memory on half-forgotten subjects, and instructing himself in more recent changes, to answer satisfactorily most of the questions set in his examination papers.

In order to introduce a number of questions similar to those generally propounded, it was considered desirable to arrange the matter in the form of Questions and Answers.

As it was obvious that the greater part of the information necessary to the Royal Artilleryman must also be useful and acceptable to his brethren of the Reserve Forces, the compilers have endeavoured to render the volume a handy book of reference for the latter, by the general arrangement and choice of subject, and by appending a Vocabulary of Technical Terms, Lists of Service Ordnance, &c.

To Owen's "Modern Artillery", and the Text-books on Ammunition, Gunpowder, and Carriages, published by Authority, the compilers are indebted for the principal part of the information on Artillery subjects.

In Military Law, much valuable assistance has been derived from Captain Tulloch's excellent "Elementary Lectures", whilst the invaluable "Soldier's Pocket Book", the "Hand-book of Field Service", and "Artillerist Manual" have supplied the answers to many of the miscellaneous questions.

The writers make no profession to have done more than collate and arrange in a convenient form the Words of Authority, of Science, and Research, yet they confidently believe that, for a work of this scope and nature, there is a good field in the Service.

There are doubtless many defects; but, should the success of the present edition demand a second, it is hoped, through advice and assistance, offered either in kindness or criticism, to correct all that is defective, and still further improve what is good.

ALDERSHOT, *January 1, 1876.*

NOTE.—*The Alphabetical References are printed in CAPITALS at the head of each page, and in **thick type** in the margin. The minor non-alphabetical references are printed in small type in the margin.*

EXAMINATIONS FOR PROMOTION.

EXTRACTS FROM SECTION 4, QUEEN'S REGULATIONS.

43. Lieutenants of Artillery, before they are eligible for pro-Subjects. motion to the rank of Captain, will be required to pass an examination in—

(a.) Regimental Duties.

(b.) Military Law.

(c.) Drill.

They will also be required to pass an examination in Artillery.

44. The Subjects and Text-books will be notified from time to Text-books. time in Regimental Orders.

45. Every Officer appointed after 30th October, 1871, is re-Limit as to quired to pass within five years from the date of his commission as Time. Lieutenant, or he will be liable to be removed from the service, under the provisions of Article 4, Royal Warrant, 22nd March, 1872, but applications for an extension of time in cases of illness or other unavoidable circumstances will be considered.

56. For the purpose of conducting the examination, instruc- Board. tions will from time to time be issued to the General or other C.O. to assemble a Board, to consist of 3 members, viz., a Field Officer (R.A. if possible), an Officer of the Staff, and a Captain, R.A., or an officer of that corps who has passed the examination.

57. That portion of the examination which can be best carried Examination. on in writing will be conducted by means of questions prepared by the D.A.G. The questions in Military Law will be furnished by the Director-General of Military Education. The *visd voce* and practical examination will be conducted by the Board.

Note. The attention of officers is called to para. 45, Queen's Regimental Regulations, in a Regimental Order dated September, 1875, and Order. *Sept.*, they are recommended to pass the examination *at least 6 months' 1875.* before the expiration of the five years.

SYLLABUS AND TEXT-BOOKS,

From Regimental Order, 18th July, 1872.

I.—REGIMENTAL DUTIES.

Duties of an officer commanding a Field Battery, including supply of Small Arm Ammunition,.....	} Regimental Standing Orders and Manual of Artillery Exercises Vol. II. (Field)
„ in charge of a Division,.....	
„ orderly officer and those of the orderly N.C.O.s, ...	
Regulations respecting Parades,.....	} Regimental Standing Orders and Queen's Regulations.
„ „ Stable duties,.....	
Duties on a March,.....	
Duties of an officer in charge of an Artillery Division,.....	
Duties of an officer in charge of a Guard and Picquet,.....	} Royal Clothing Warrant.
General Regulations with regard to supply of clothing and necessaries, ...	
Regulations with regard to pay and allowances, including Good Conduct Pay, ...	} Revised Army Regulations, Vol. I., pars. 581, 574-600, 614, 633-635, 648, 693-709, 725, 889, 949, 1079-1082.

II.—MILITARY LAW.

Mutiny Act, Clauses 1-28, 42-59, 63-74.	} Simmons on Courts Martial, or Pipon's Manual.
Army Service Act. Army Reserve Act. Militia Reserve Act. Articles of War. Rules of Evidence, &c.,....	

III.—DRILLS.

<i>Infantry—</i>	
Part II. Company Drills, General Rules and Sections, 1 to 20,.....	} Field Exercises and Evolutions of Infantry.
Part III. Formations and Evolutions of a Battalion, omitting from Section 36 to end, ...	
Part IV. Formations and Movements of a Brigade : General Rules, with those for Second Lines, and positions of Artillery, ...	
Part VI. Advanced and Rear Guards, &c., Route Marching, &c., Sections 3-19,.....	

Cavalry Regulations. Sections 1 to 12, and 14 and 15.

Artillery. Parts I. to IV., Manual of Artillery Exercises (Field) omitting Parts VI., VIII., X., and XI. *N.B.*—For this is substituted the new Manual of 1875.

IV.—ARTILLERY.

Ordnance (including principles of rifling), their carriages, platforms, and am- munition, ...	}	Gun Factory and Carriage De- partment Notes.
		Treatise on Ammunition, Bar- low. Owen's Modern Artillery.
Supply and care of Ordnance, Ammuni- tion, and Stores, ...	}	Revised Army Regulations, Vol. III.
		Supply of Stores to an Army in the Field.

V.—GUNNERY.

Circumstances under which the different kinds of Ammunition should be used. Position and employment of Artillery in a Fortress—at a Siege —in the Field, ...	}	Owen's Modern Artillery.

Manufacture and Proof of Gunpowder,.....Treatise by Captain F. M. Smith.

LIST OF WORKS

CONSULTED OR EXTRACTED FROM.

	Modern Artillery, Lieut.-Col. Owen, R.A.
	Treatise on Artillery, Major-Gen. Boxer, R.A.
	Treatise on Military Carriages, &c., Captain Kemmis, R.A.
	Treatise on Ammunition, Major Barlow, R.A.
	Text-book on Rifled Ordnance, Captain Stoney, R.A., and Captain Jones, R.A.
	Handbook of Manufacture and Proof of Gun- powder, Captain Smith, R.A.
Artillery, &c., ...	Handbook of Field Service.
	Notes on Gunpowder, Major Goodenough, R.A.
	Short Notes on Field Batteries, Captain Orde Browne.
	Artillerists' Manual, Major Griffiths and Major Duncan, R.A.
	Questions and Answers on Artillery Subjects, Colonel Vesey, R.A.
	Ditto, ditto, Colonel Burn, R.A.
	Proceedings R.A. Institution.
	Manual of Artillery Exercises, Garrison and Field.
	Mutiny Act and Articles of War, 1875.
	Simmons on Courts Martial.
	Pipon's Manual of Military Law.
Military Law, ...	Elementary Lectures on Military Law, Captain Tulloch.
	Elements of Military Administration and Mili- tary Law, Captain Boughey.
	Standing Orders, Royal Artillery.
	Royal Clothing Warrant.
Interior Economy, ...	Royal Warrant for Pay and Promotion.
	Army Circulars.
	Queen's Regulations.
	Soldier's Pocket Book, Sir Garnet Wolseley.
Miscellaneous, ...	Manual of Field Exercise.
	Manual of Field Fortification, &c.

LIST OF ABBREVIATIONS.



A.	.	.	.	.	For Ammunition.
A.G.	.	.	.	.	„ Adjutant-General.
B.L.	.	.	.	.	„ Breech-loading.
B.L.R.	.	.	.	.	„ Breech-loading Rifled.
B.U.	.	.	.	.	„ Built-up.
C.B.	.	.	.	.	„ Confinement to Barracks.
C.M.	.	.	.	.	„ Court Martial.
C.O.	.	.	.	.	„ Commanding Officer.
C. of G.	.	.	.	.	„ Centre of Gravity.
F.G.	.	.	.	.	„ Fine Grain.
F.S.	.	.	.	.	„ Field Service.
G.C.	.	.	.	.	„ Good Conduct.
G.O.C.	.	.	.	.	„ General Officer Commanding.
G.S.	.	.	.	.	„ General Service.
I.V.	.	.	.	.	„ Initial Velocity.
L.G.	.	.	.	.	„ Large Grain.
L.S.	.	.	.	.	„ Land Service.
M.L.	.	.	.	.	„ Muzzle-loading.
M.L.R.	.	.	.	.	„ Muzzle-loading Rifled.
N.C.O.	.	.	.	.	„ Non-commissioned Officer.
O.	.	.	.	.	„ Ordnance.
O.C.R.A.	.	.	.	.	„ Officer Commanding Royal Artillery.
O.P.	.	.	.	.	„ Old Pattern.
P.	.	.	.	.	„ Pebble.
R.	.	.	.	.	„ Rifled.
R.A.	.	.	.	.	„ Royal Artillery.
R.F.G.	.	.	.	.	„ Rifle Fine Grain.
R.L.	.	.	.	.	„ Royal Laboratory.
R.L.G.	.	.	.	.	„ Rifle Large Grain.
R.M.L.	.	.	.	.	„ Rifled Muzzle-loading.
S.A.	.	.	.	.	„ Small-arm.
S.B.	.	.	.	.	„ Smooth-bore.
S.S.	.	.	.	.	„ Sea Service.

' Over a figure indicates either *feet* or *minutes*.

" Over a figure indicates either *inches* or *seconds*.



CORRIGENDA.

Page 5, line 24, *for* 150 *read* 105.

„ 105, „ 22, *after* 2d. *insert* or more.

„ 196, „ 10, *for* 300 *read* 200.

NOTE.—A Warrant, dated 26th November, 1875, has been issued, ordering a new classification of N.C.O.s and men for allowances, but the details are not sufficiently promulgated to permit the alteration of the Question and Answer on PENSIONS.

QUESTIONS AND ANSWERS

ON

Artillery, Military Law, Interior Economy,

AND

MISCELLANEOUS SUBJECTS.

A.

*What are the existing regulations with regard to absence **Absence.**
without leave ?*

If under 5 days, Commanding Officer may deal summarily with the case ; if over 5 and under 21 days, the man may be tried by Regimental Court Martial ; or, if the trial is dispensed with by the General Officer commanding, who alone has authority to do so, the C. O. must inflict a punishment entailing a Regimental entry ; if over 21 days, a Court of Inquiry is held to declare the man's illegal absence, and on his return he must be tried by a Court Martial for *desertion*, unless the G. O. commanding directs him to be tried by Regimental C. M. for absence without leave.

See **Courts of Inquiry, Courts Martial, and Desertion.**

*When Battery Sergeant Majors revert to Sergeants, and **Acting N. C.**
Acting Bombardiers are deprived of their Acting rank by ^{Os.}
award of C. O., what record is kept of the circumstance ?*

An entry is made in the Battery Defaulter Book, but it is not recorded in the Regimental Defaulter Book.

When an Acting Bombardier is brought to trial, how is he arraigned ?

As Gunner (Acting Bombardier), or Driver (Acting Bombardier), as the case may be.

Addresses *What are the regulations with regard to addresses at the close of the evidence for the Prosecution on a C.M.:—*

(a) *When prisoner does not adduce evidence ?*

(b) *When prisoner adduces evidence ?*

(c) *When defence has let in evidence in reply ?*

(a) At the close of the evidence for the prosecution, the prisoner, having been asked if he intends to adduce evidence, and having answered in the negative, the prosecutor may proceed to address the Court a second time, for the purpose of summing up the evidence for the prosecution, after which the prisoner may address the Court in his defence. At the conclusion of the prisoner's address, the deputy-judge-advocate will sum up the whole case.

(b) He may open his case with an address, before calling witnesses. At the conclusion of the evidence he may again address the Court, after which the prosecutor will be entitled to a reply.

(c) In those special cases where evidence is allowed in reply, the second address of the prisoner is to be made after such evidence, and immediately before the prosecutor's reply, which is to be followed by the address of the deputy-judge-advocate.

Adapter. *What is an adapter ?*

A gun metal bush with the interior of the General Service gauge used to convert the obsolete Moorsom to the G. S. gauge by screwing it into the fuze hole of the shell. There are two distinct adapters, one for spherical and one for B.L. rifled shell, the latter being rather longer than the former.

Advanced Guards. *Explain the functions of an Advanced Guard ?*

An Advanced Guard is formed in front of a column or of the columns of an army for the purpose of covering and concealing the movements and formation of the main body, feeling the way through a country, gaining intelli-

gence of the enemy, and giving timely notice of his vicinity or approach, in order that the main body may have time to prepare for making or repelling an attack.

The advanced guard in its composition should represent Composition a miniature army ; for a Division, the following may be taken as the normal strength.—The divisional regiment of cavalry, minus 1 troop (to be left with G. C. O. at head of main column) the odd battalion of infantry not attached to either brigade ; 4 to 6 guns ; one company R.E., and a detachment of the ambulance.

This must depend on the state of preparation for attack Distance f in which the army is, but it would vary in different cases main body. from one mile to four or five.

Great caution must be observed on approaching a village or entering a defile or hollow-way, the flanks of all objects must be turned, woods, ravines, and morasses examined, and intervening hills ascended by a single file who will signal the result of his observations to the remainder of his party.

*How is the quantity of Ammunition provided (1) to Ammuni-
Coast Batteries, (2) to Fortresses, (3) to siege trains, tion for
regulated ? Coast Ba-
teries &c*

(1) Coast Batteries should be provided with at least sufficient for one day's firing, the general proportion of made-up ammunition being laid down at 200 rounds per gun. The proportion of different projectiles must depend upon the situation of the battery, and the purpose for which its fire is required.

(2) The quantity of ammunition required for the defence of a fortress is regulated by its extent, the nature and number of its ordnance, and the probable duration of any siege it may have to sustain. It is generally considered that, for a fortress of very large size, 200,000 to 300,000 projectiles would be necessary ; for smaller ones

For Fortresses from 40,000 to 50,000 ; and for forts, from 15,000 to (continued). 20,000.

The quantity of ammunition to be maintained at home and abroad for Rifled Ordnance is as follows :—

H O M E.

12" M.L.R. Gun, 100 Rounds per Piece.

11	"	"	100	"	"
10	"	"	150	"	"
9	"	"	150	"	"
7	"	"	150	"	"
64-pr.	"	"	100	"	"
7" B.L.R.	"	"	75	"	"
40-pr.	"	"	100	"	"

A B R O A D.

12" M.L.R. Gun, 250 Rounds per Piece.

11	"	"	250	"	"
10	"	"	250	"	"
9	"	"	300	"	"
7	"	"	300	"	"
64-pr.	"	"	200	"	"
7" B.L.R.	"	"	200	"	"
40-pr.	"	"	200	"	"

For a siege train.

(3) For a siege train the supply of ammunition must of necessity depend on the duration of the siege and the vigour of the defence, but no greater number of rounds must be issued than the pieces of ordnance can stand without being rendered unserviceable ; according to Revised Army Regulations, 500 rounds are issued per gun.

Angle

Of Elevation.

What is the Angle of elevation of a gun ?

The angle the *line of fire* makes with the *line of sight*.

Of departure.

What is the Angle of departure ?

The angle a tangent to the trajectory makes with the horizon on the shot leaving the muzzle ; this frequently differs from the angle of elevation in consequence of the muzzle being thrown up, and (with windage) from the re-

bounding of the projectile from the bottom of the bore near the muzzle.

What is the angle of descent?

Of descent.

The angle made by a tangent to the trajectory with a horizontal plane, at the first graze, or at the point of impact on the object.

What is the clearance angle?

Of clearance.

The angle of elevation obtained when the tops of the tangent scale and dispart sight, and the notch on the muzzle are in line. If the scale be raised above this angle, the dispart sight falls below the line joining the head of the scale and the muzzle, and the muzzle notch must be taken as the second point of sight.

See **Life-saving.**

**Apparatus
Life Savin
Rocket.**

What are the Armaments of M.L.R. guns for:—

**Arma-
ments.**

(1) *Field and Position Batteries?*

(2) *Siege trains?*

(3) *Garrison Batteries?*

- | | | | |
|-------------------------------|---|------------|-------------|
| (1) Horse Artillery Batteries | 6 | 9-prs. of | 8 or 6 cwt. |
| Field Batteries (light) | 6 | 9-prs. of | 8 cwt. |
| Do. (heavy) | 6 | 16-prs. of | 12 cwt. |
| Position „ | 6 | 25-prs. | |
| „ „ | 4 | 40-prs. | |

- (2) A Siege train of 150 pieces is composed of:—
- | | | |
|----|---------------------------------------|--|
| 55 | 64-prs. | } On travelling carriages with siege
limbers. |
| 20 | 40-prs. | |
| 30 | 8" howitzers on travelling carriages. | |

See **Sieges.**

(3) The heavy garrison guns are those of 7" calibre and upwards. These, with the 80-pr. and 64-pr. converted guns, are the M.L.R. armaments for garrison service, but there are still many 7" and 40-pr. B.L. guns and smooth bores mounted in garrisons.

Garrisons
invued). There are no rifled mortars as yet in the service ; the 13", 10", and 8" S. Bs., with a proportion of $5\frac{1}{2}$ " and $4\frac{3}{8}$ " bronze mortars are the only natures of that class of ordnance employed.

See **Appendix I, B.L., M.L.R., S.B., &c.**, for all details.

l-
ng's
s.

See **B.L., Principles, &c.**

y
is.

See **Organisation.**

y
rve.

What is the Army Reserve ?

A Reserve Force for the United Kingdom which the "Army Reserve Act" of 1867, and the "Army Enlistment Act" of 1870, together with the Secretary of State's instructions, provide for as follows :—

It is not to exceed 50,000 men, and is divided into two classes :—

Class I.—Not to exceed 20,000 men, who, in case of imminent national danger or actual invasion, are liable to serve anywhere ; to consist of men who have served for not less than 3 years in the Army, and whose age does not exceed 34 years. They receive £6 a year, but have no claim to pension.

Class II.—Not to exceed 30,000 men ; to serve at home only, and to comprise men enrolled under former acts, out-pensioners, and men who have served 12 years in the army and are over 34 years of age.

Men enrolled may be formed into separate corps, or attached to regiments ; to be called out for 12 days' training, or 20 drills annually. The term of service to be directed by regulations under the Act from time to time, and each man to sign a declaration as to his own period. Men of Class I. may be attached to the Militia for training, and will be dealt with as militiamen for the time being.

The force may be called out at any time to aid the civil power, and men may volunteer their services for 6 months,

during which time they will be kept on duty and pay in the same way as the regular forces.

The reserve force is subject to Military Law :—

- (1) When out for training.
- (2) Any of the force who have volunteered for duty.
- (3) When called out in aid of civil power.
- (4) On permanent service in case of war.

And can be tried by C.M. within 12 months after an offence has been committed.

See Courts Martial.

Describe the Wrought-iron Field Axletree.

Axletrees.

It is let into a wooden (or wrought-iron) bed, fitted underneath the brackets and trail by *housings*, and attached to the carriage by two axletree bands. The axletree is also secured at each end of the bed by a *yoke-hoop* and coupling-plate. The arms have a slight inclination downwards, termed the *hollow*, for the purpose of bringing the lower spoke of the wheel vertical when there is a *dish*. Wooden bed for gun carriage, limber and wagon.

When the lower spoke is not brought quite vertical by the *hollow*, the wheel is said to have a *strut* which, although rather a disadvantage on level ground, assists the wheel under the most trying circumstances, namely, when it dips into a rut. An inclination to the front, called the *lead* is also given to the axletree arm for the purpose of placing the front part of the wheel as, in revolving, it approaches the ground more in the direction in which the carriage is travelling, and from which the *dish* of the wheel and *hollow* of arm cause it to deviate.

The diameter of the arm at each end is made a minimum, consistent with strength, for the sake of lightness, and to diminish friction. For this reason, and also to facilitate the putting on of the wheel, the arms are made conical, the point being rounded off to render it less liable to catch *against anything*.

The pipe box in which the axletree arm works is made of gun metal, of conical form, and enlarged towards the middle to make a grease chamber.

Wrought-iron
bed for gun
carriage.

In the later pattern, the axle-tree bed is of wrought-iron, constituting with the axle a beam of box-girder section. The axletree forms the bottom of the box, a piece of angle iron, riveted along each side of the body, the sides, while the top is formed by a plate riveted upon the upper side of the angle iron pieces. The top plate and angle iron are slotted to admit the bed into its recesses in the brackets of the carriage, where it is secured by being riveted to the frames of the latter, and by bracket-stays in front and rear riveted to itself and to the frames.

For Limber.

The bed for the limber is formed in a similar manner, but being necessarily deeper, its sides are of plate iron, a piece of angle iron being riveted along each for the top plate to rest upon and to be secured to.

For Wagon.

Axletree bed similar to that of gun carriage.

B.

*What are the Incendiary Projectiles that are used in the **Balls**. service ?*

(1) Carcasses ; (2) Ground Light Balls ; (3) Parachute Light Balls ; (4) Smoke Balls.

Describe them and explain their use.

(1) A *Carcass* is a cast-iron Spherical Shell having three *Carcass*. vents in upper hemisphere, but no fuze hole ; thickness of metal $\frac{1}{2}$ diameter ; it is filled with a composition which burns with a violent flame and is difficult to extinguish. The composition is put in hot and three holes made in it in prolongation of vents ; these holes are driven with fuze composition and matched with quick match. Vents are plugged with brown paper and secured with kit plaster, both of which must be removed before firing. Carcasses are used to fire shipping, buildings, &c., and are fired from all natures of S.B. Guns, Howitzers, Carronades, and Mortars.

(2) *Ground Light Balls* are fired from Mortars only. Ground Light Calibres 10", 8", $5\frac{1}{2}$ ", $4\frac{3}{8}$ ". They have a wrought-iron skeleton frame partially covered with canvas, filled with composition which burns with a brilliant light, holes are made in it driven with fuze composition and matched as in Carcasses. Body woolded with twine—8" and 10" have 5 vents, others 4. Vents are secured with plugs and kit plaster which are removed before firing. They are used at night to discover working parties, &c., and burn from 9 to 16 minutes.

(3) The *Parachute Light Ball* consists of a thin iron *Parachute* shell formed by two hemispheres riveted together, inside *Light Ball*. of which are other two iron hemispheres, the lower one

RALLS—BEDS.

and the upper one with the calico tightly in, and attached to the case by the hemisphere is attached to the one outside. The parachute is connected to the composition by ropes and the leaders of quick match pass from a fuze in the outer hemisphere to a vent, in the bottom of the composition, which is primed with a fuze composition, so that when the ball is from a mortar and has reached the highest part of its ascent, the fuze ignites the quick match and priming, causing the halves of the outer shell to separate, and release the parachute which expands and descends very slowly with the composition burning brightly from the vent. This light was introduced to remedy the following defects to which the ground light ball is subject:—viz., it can be smothered by shovelling earth over it; if it is in a ditch the light is much obscured; if projected above the object it would have a contrary effect to that intended; and its discovering power is very low.

(4) *Smoke Balls* consist of a paper shell, having one vent, and are filled with a composition which evolves a large volume of smoke. They are used to put in the enemy's mines and conceal operations; they burn from 1 to 8 minutes.

See Cartridges and Gunpowder.

See Organisation, Armament, C. O., Embarkation, Encampment, &c.

What are the different natures of mortar beds for land service?

Cast-iron beds for 8", 10", and 13" mortars.

Wood beds for 4½" and 5½" mortars.

The cast-iron beds consist of two brackets and two transoms held together by rivets. They are provided with

running-up bolts and horns for traversing, and are fitted with cap squares and quoins.

The beds for the two smaller natures of mortars are formed, each, of a block of Sabicu or African oak; hollowed out to receive the breech of the mortar and fitted with cap-squares, a quoin and rope handles.

When S. S. mortar beds are employed for L. S., they are mounted with their octagon decks on special ground platforms, india-rubber rings being placed between and the whole secured together by a central bolt.

What are the regulated daily allowances of forage, and Billets, provision to men by an innkeeper on whom parties are billeted, and what remuneration does he receive?

10 lbs. of corn, 12 lbs. of hay, and 8 lbs. of straw per horse.

One hot meal consisting of $1\frac{1}{2}$ lbs. meat, weighed before cooking, 1 lb. bread, 1 lb. potatoes or vegetables, 2 pints of beer, salt and vinegar. In Great Britain he receives for forage 1s. 9d. per horse, for the hot meal 1s. $2\frac{1}{2}$ d., and for the soldier's bed $2\frac{1}{2}$ d. In Ireland he provides bed, fire for cooking, candles, vinegar and salt, for which he receives 4d.

What allowance do officers and men receive on the march? Allowances
to Officers and
Men.

Officers, 10s. the first day, 7s. 6d. every other day.
Men 3d. per diem (last day inclusive).

To what punishment is an officer liable who offends against the laws affecting billets, and what is the clause of the mutiny act?

He is liable, by clause 87, to be cashiered upon conviction before two justices of the peace, on the oath of two credible witnesses.

Blocks.

What blocks are used in the Artillery service? Explain the difference between the Admiralty and Bothway's blocks.

The service blocks are single, double, treble, and snatch, and are of the following dimensions:—18, 15, 12, 10, 9, and 8-inch.

An Admiralty block is a simple wooden shell, bound on the outside, in the direction of its length, with a rope strap which is called *the strap* of the block.

Bothway's blocks are iron strapped, the strapping passing inside the shell, and affording a better support to the pin upon which the sheaves turn, than the Admiralty block does. These blocks are fitted with swivel hooks. The shell is built up of several parts riveted together, the iron straps also being in separate parts. Each division of the block has its own strap which is pierced in the middle to receive the pin.

Bore of a Gun.

What considerations regulate the length of the bore of a piece of Ordnance?

The length of the bore must be such as to allow of the decomposition of its whole charge, a certain time being necessary for its complete combustion. Several practical considerations, such as the weight of the piece, and the space it will have to occupy, will also limit the length of the bore. The length of the bore of a rifled piece, intended to fire a given charge and weight of projectile, should depend upon the calibre and the system of rifling adopted.

Forces acting in Bore.

What forces act upon a projectile within the bore of a gun?

(a) The pressure exerted by the gas from the charge or the propelling force.

(b) The retarding forces:—(1) The resistance of the condensed air in front of the shot. (2) The friction between the shot and the bore. (3) The resistance of the

projectile in a rifled gun to rotatory motion. (4) The resistance in some rifled guns, due to the necessity of compressing the outer portion of the projectile. From these considerations it will be seen that the bore must not be too long, as the velocity would be decreased by the increase of the retarding forces.

Explain the use, form, and method of attachment of **Bottoms, Wooden.**

They are used with shot fired from S.B. bronze guns to save the guns, with shot carried with S.B. iron guns of position to steady them in the limbers, with all S.B. shells, except mortar shells and the 100-pr. naval shell which has a top, and with carcasses, except when fired from mortars. They are necessary with shells to keep the fuze, and with carcasses, the vents in the proper position. They are conical for all shell guns and howitzers which have gomer chambers, and for all unchambered ordnance of corresponding calibre; hemispherical for the $5\frac{1}{2}$ inch and $4\frac{3}{8}$ inch howitzers, and cylindrical for all other ordnance.

They are made of elm, alder, or teak, and are of two classes, *plank* and *end*. The grain runs plankways, except for shrapnel up to 24-pr., where it runs lengthways, and is carried higher up the shell, being secured from splitting by a tin strap, this ensures the bottom breaking up, and averts any danger in firing over skirmishers.

Bottoms for L.S. are attached by a single expanding gun-metal rivet, driven through a hole in the bottom into an under-cut hole in the shell or shot. For S.S., a piece **Naval Bottoms.** is cut out of the centre of the bottom to admit of the metal of the shells being in contact in double shotting, and it is therefore necessary to fasten them on by means of two inclined rivets.

What is the difference between brass and bronze? **Brass and Bronze.**

Brass is an alloy of copper and zinc, bronze of copper and tin.

**Breaching
revetments.**

Explain the method of breaching revetments.

The wall to be breached is first cut in a horizontal direction, and then vertically, at such distances as the strength of the masonry may require. The general height of the horizontal cutting would be about $\frac{1}{3}$ the total height of the escarp from the bottom, and its length from 20 to 30 yards. This length of wall would be divided into as many portions as there are guns in the breaching battery, each gun commencing by firing a shot at the outward extremity of its portion, and then others at regular intervals, until the whole is marked out. The fire will then be directed on points exactly between the former ones, and any salients left uninjured will be destroyed.

The vertical cuttings are formed by first firing a shot a certain distance above the horizontal line and then another in the centre of this distance, and then destroying the intermediate salients.

The vertical cuttings need not be carried to a greater height than one half the distance between the horizontal line and the *cordon*.

After the fall of the revetment, shot and shell should be fired to bring down the earth, to form a ramp or roadway into the place; this should not have a greater slope than 45°.

**Oblique
Breaches.**

In forming a very oblique breach, each shot must be directed at that part of its range which is nearest the breaching battery, and a first round fired thus. The second round must also be fired at the first holes, in the direction of the horizontal cutting, and so on, until all the openings join and form but one.

**Breaching a
counter-
arched revet-
ment.**

In breaching a counter-arched revetment, an oblique fire should be directed on the counter-forts, in order to cut them through horizontally.

Indirect or curved fire may be advantageously employed from rifled guns.

What are the advantages and disadvantages of the breech-loading system? **Breech Loading Ordinance.**

(1) That a projectile of larger diameter than the bore can be used ; (2) that the gun can be loaded when run up, the gunners being, therefore, less exposed ; (3) that the gun can be worked in a smaller space (than a M.L. piece) ; (4) the cleaning of the bore can be more readily effected and any ignited substance left in the bore can be seen and removed ; (5) there is no danger of the shot not being home.

The disadvantages are :—(1) That the construction is more complicated than that of a M.L. piece, and skilled labour is required to keep it serviceable ; (2) that both gun and ammunition are more costly ; (3) that if the gun be of large calibre the breech-loading apparatus will be unwieldy ; (4) that with the same weight of metal the breech-loading is a weaker and less enduring construction than the M.L. ; (5) the strain is much greater ; (6) the absence of windage makes a more complicated and dangerous fuze necessary.

What are the classes of service B.L. guns?

Classes.

The Screw and the Wedge.

Name the principal parts of a Screw B.L. Armstrong gun and describe generally the construction. **Screw B.L. Gun.**

- | | |
|---------------------------|-------------------|
| (1) Barrel or inner tube. | (5) Vent-piece. |
| (2) Breech-piece. | (6) Breech-screw. |
| (3) Trunnion-ring. | (7) Tappet-ring. |
| (4) Coils. | (8) Lever-ring. |

In the *barrel* are the bore, the shot chamber, and the powder chamber ; at the end of the powder chamber in all guns except the 7-inch is screwed a copper ring against the outer edge of which the copper facing of the vent-piece fits and so closes the bottom of the bore. In the 7-inch gun this ring is of wrought-iron.

screw B.L.
gun (*con-
tinued*).

The barrel is made either of wrought-iron coils or a solid cylinder of steel tempered in oil.

The *breech-piece* is a solid forging of wrought-iron ; it is bored, turned, and shrunk on to one end of the barrel, a slot is drilled through it and the coil above for the vent-piece, and behind this a screw is cut for the breech-screw.

The *trunnion-ring* is a solid wrought-iron forging which is turned, bored, and shrunk on to the gun.

The *vent-piece* is of iron or steel, fitted, except in the 7-inch, with a copper ring which has an angular face to correspond with the other copper ring at the end of the powder chamber.

The vent-piece contains the vent which descends vertically until it reaches the prolongation of the axis of the bore, when it turns at right angles and leads into the bore.

Tin Cup.

A *tin cup* is necessary with the 7-inch gun to prevent the escape of gas, as there is no copper ring. See **Tin cup**.

The *breech-screw* is made of steel or wrought iron, and is worked forwards or backwards by the *lever* and *tappit* ; it is hollow to allow of the charge being passed through in loading.

The *tappet-ring* is of wrought iron, fits on to the octagonal part of the breech-screw, and has projections called *cams*, against which the lever acts, thus moving the breech-screw backwards or forwards.

The *lever-ring* is also made of wrought iron, and fits on to the circular part of the breech-screw.

The Wedge
Gun.

Describe generally the Wedge B.L. gun.

In the *wedge* and *stopper* gun a slot passes through the breech from side to side, and the parts which close the bore are therefore inserted or withdrawn at the side of the piece instead of at the top.

The *stopper*, which is made of iron or steel, has a projecting face to fit into the bottom of the bore, and on this face a *tin cup* is placed to prevent the escape of gas. The stopper has studs on the top and bottom which travel in guiding grooves.

The *wedge* is made of iron, with a *hammer* fitted loosely across it, having a play of about 4 inches, and a handle at both ends.

On the top of the breech is a *slide plate*, the motion of which backwards and forwards raises and lowers a *locking-pin* passing through the metal of the gun into the slot; on the wedge is a recess into which the end of the *locking-pin* drops, part of the recess being cut in the surface of the hammer.

Describe the method of loading the Wedge gun.

To load the
Wedge gun.

Cover the vent with the *slide plate*, by which the *locking-pin* is raised up out of the recess; loosen and push wedge out by the hammer; force back the handle of the *stopper* to withdraw face from the bore, and then pull *stopper* out to side; insert shot and cartridge and place *tin cup*; (the wedge is hollowed out so that the charge can be loaded through it); replace wedge, tighten it by a smart blow from the hammer, return the latter into the slot, and draw the *slide plate* from the vent.

What are the advantages claimed for the Wedge over the Screw B.L. gun?

Advantages
Wedge Gun

- (1) Greater facility and less labour for working the gun.
- (2) Little or no escape of gas.
- (3) Impossibility of firing till the wedge and stopper are secured.
- (4) Greater simplicity in the fittings.
- (5) The detachment not so much exposed.

What are the objections?

Objections

- (1) Liability to injury owing to the wedge making an

effort to free itself—when the gun is fired—from the breech slot.

(2) Liability of wedge and stopper to become jammed with dirt.

Arm- *What are the main principles carried out by Sir William*
s prin- *Armstrong in the construction of his guns?*

(1) The arranging the fibre of the iron in the several parts, so as best to resist the strain to which they are exposed; thus the walls or sides of the gun are composed of coils with the fibre running round the gun, so as to enable it to bear the transverse strain of discharge without bursting, whilst the breech end is fortified against the longitudinal strain by a solid forged breech-piece, with the fibre running along the gun.

(2) In shrinking the successive parts together, so that not only is cohesion throughout the mass ensured but the tension is so regulated that the outer coils contribute their fair share to the strength of the gun.

See Principles.

ges, de- *How are batteries placed for the defence of a tête-de-*
e of. *pont?*

Two batteries should be placed so that they may concentrate their fire upon the main body of an advancing enemy, and a third battery directly in rear of the bridge in order to prevent its use or repair by the enemy after the work has been taken.

ritleness. *Define the term brittleness.*

Brittleness is the tendency to break more or less readily under compression, either gradual or sudden.

ad *Describe the Broad Arrow Kitchen.*
ow
chen.

The Broad Arrow Kitchen consists of three trenches converging to a point, with their mouths connected by a

semicircular trench, and a chimney from 5 to 6 feet high and 1 foot in diameter, made of turf.

The trenches are 12 feet long and 9 inches broad, with splay mouths, the deepest parts being 18" deep, and slope upwards to a depth of 6" where they enter the chimney, the bottom of which is a little lower than the bottom of the trenches. The semicircular trench is 21" deep. The holes for the kettles are moulded in clay, the intervals across the trenches being covered with sods (turf down), or with stones, hoop iron, or sticks plastered with clay. If clay be plentiful the insides of the trenches may be rendered with it, the dimensions in this case being slightly increased.

See Brass.

Bronze.

Describe the Hydraulic Buffer.

Buffer, h
draulic.

The Hydraulic Buffer is used as a means of checking recoil with heavy ordnance mounted on sliding carriages. It is simpler in construction than the compressor and is entirely self-acting. It consists of an iron cylinder with rod and piston, the latter having four holes to allow of the passage of the fluid from one side to the other when moving. The cylinder is attached to the platform by two bands and has a filling hole in rear and an emptying cock in front. The piston rod is connected to the carriage which is provided with *clips* to prevent its rising on recoil. The cylinder is filled with water or oil; when the gun recoils the piston being forced rapidly back, is resisted by the fluid, which can only pass through the holes at a certain rate, and thus the recoil is checked.

What is a Burster?

Burster.

A wrought-iron cylinder used with Field Service Segment Shells (20-pr. and lower natures) to contain the bursting charge, as the powder chamber has a slightly less

diameter than the fuze hole. The Burster is dropped into the powder chamber, the brown paper cover in which it is issued being retained and the top torn off to allow ignition.

sting
rges.

How are Bursting charges protected against the risk of premature explosion?

Either by lacquering the interior of the Shell, or by placing the powder in a separate case or bag, made of serge.

C.

What is the Calibre (1) of a S.B. ; (2) of a Rifled piece Calibre. of Ordnance ?

- (1) The diameter of the bore.
- (2) The diameter of the largest spherical shot that can be put into the bore.

Upon what does the calibre of a piece of ordnance depend ?

Upon the form and nature of the projectile. A rifled gun requires less calibre than a S.B. one, if both fire projectiles of equal weight.

When are large and small calibres advantageous ?

If a long range or great penetration are wanted from a rifled gun, a small calibre is advantageous ; for, of two elongated shot equal in weight, the one with the smallest diameter will oppose least surface to the resistance of the air. Large calibres are necessary in shell guns, as large capacity in shell is requisite for bursting charge.

Large and Small Calibres.

What other considerations influence the size of the calibre ?

The calibre must be suited to the charge. As the diameter of the bore decreases, so with a given charge must the length of the cartridge be increased, and the conversion of the powder into gas be retarded.

How does the increase of calibre affect, (1) the initial velocity, (2) the strain on the gun ?

Influence of Initial Velocity and Strain.

- (1) With increase of calibre, as the gas exerts a certain pressure per square inch on the base of the shot, the initial

velocity will increase, the projectiles with the largest base receiving the most pressure.

(2) As the calibre increases, the bottom of the bore will receive a greater, and the metal surrounding the charge a less proportional strain; but the latter will probably increase with the calibre until the diameter of the cartridge is about equal to its length, on account of the more rapid conversion of the charge into gas.

re and
h.

What should regulate the calibre and length considered together?

They should be so regulated that there should be no waste of powder, and that the force of the gas should be expended in giving velocity to the projectile with as little strain as possible on the metal of the gun.

of 3-in.
re.

Name all the guns of 3-inch calibre in the service.

B.L. 12-pr. of 8 cwt., and 9-pr. of 6 cwt.; bronze M.L.R. 9-pr. of 8 cwt., 7-pr. of 224 lbs., and 200 lbs.; wrought-iron M.L.R. 9-pr. of 8 cwt., of 6 cwt., and S.S. 9-pr. of 6 cwt.; steel 7-pr. of 150 lbs., and 200 lbs.

ips.

See Encamping.

stan
h.

Describe the Crab Capstan.

It consists of a framework and windlass with two capstan bars. The frame is formed of two straight and two curved pieces of oak scantling, bolted to a block of African oak at one end, and at the other to transoms.

The windlass is of elm and stands upright in the frame, the lower part, round which the rope is passed, is conical, the upper part cylindrical with holes through which the capstan bars, which are of ash or rock elm 16' long, are passed.

see.

See Balls.

What are the general requisites for an Artillery carriage? Carriages.
Simplicity, mobility, stability and convenience of transport.

What points should be attended to, in order to decrease as far possible the work necessary for the draught of a carriage?

(1) The wheels must have all the height they can be allowed.

(2) The mean diameter of the axletree arms must be a minimum consistent with strength.

(3) The materials composing the axletree arms and boxes must be such that the friction between them will be as little as possible.

(4) The angle of traction must be that most favourable to the motive power.

What is the angle of traction in our service?

About $6\frac{1}{2}^{\circ}$.

Angle of traction.

See **Traction**.

What force can a horse exert moving at the rate of 3 miles an hour, for 8 or 10 hours consecutively?

A force of 125 lbs.

What are the effects of discharge on a Gun and its carriage:— Effects of discharge.

(1) *When fired on a horizontal plane, point blank?*

(2) *When fired on a horizontal plane, with considerable elevation?*

(1) The momentum of the gun will be expended in forcing the carriage to the rear in the direction of axis of piece, and the strains will be exerted on the trunnion holes and from them to the axletree arms; also since C. of G. is below the axis, the whole will tend to rotate round axletree, which being checked by point of trail, the

Effects of
discharge
(continued).

point of rotation will be transferred to this, forcing the trail into the ground and lifting the wheels.

(2) The momentum, at a considerable elevation, will give a vertical shock to the carriage, causing destructive effects upon various parts of it, as well as a backward shock, somewhat less than in the former case. The wheels and trail will both be forced into the ground and divide the shock, acting vertically upon the carriage between them.

In both cases a considerable blow will be given to the head of elevating screw.

Effects on
hard and soft
ground.

State different effects when firing on hard and soft ground.

On hard ground, or ground with a considerable inclination to the rear, the effect on the trail would be very destructive, as well as on that part of the carriage to which the elevating screw is attached. On very soft ground the system would tend to rotate round the axletree, and the pressure on the elevating screw would be therefore diminished, and that on the capsquares increased.

Principles to
lessen strain.

What principles should be observed in order to lessen the destructive effect of discharge on a gun-carriage?

(1) The weight of the piece must be at a maximum, with due regard to mobility.

(2) The weight of the carriage must be at a minimum, consistent with strength.

(3) The C. of G. of the system must be as near to the axis of the piece, and as far from the point of the trail as possible.

(4) The wheels must be as light as is consistent with strength.

Classes.

How are artillery carriages classed?

(1) *Field and position carriages.*

(2) Siege carriages.

(3) Garrison carriages.

Name the different carriages attached to a Field Battery. Field Battery Carriages.

Gun carriage. Store wagon.

Ammunition wagon. G.S. wagon.

Rocket wagon. Small-arm ammunition cart.

Forge wagon.

Describe the wooden field gun-carriage.

Wooden Carriages.

The wooden carriage used with B.L. guns consists of a *trail*, two small brackets, a wooden *axletree bed* with an iron axletree passing through it, two small *axletree boxes*, an *elevating screw*, and two *wheels*.

What is the inclination of the trail with the ground?

Inclination of trail.

Generally about 21° .

Describe the limber and ammunition wagon for B.L. field guns. Limber and Wagon for B.L. guns.

The limber consists of a framework of wood, with wheels of equal height to those of the gun-carriage, and carries two boxes for the ammunition, &c.; the frame consists of the *axletree bed* and *block*, connected with the *splinter bar* by 3 *futchells*, and in front of the boxes are the *platform board* and *foot-board*. The trail of the gun carriage hooks up to a crooked *pintail* at the back of the limber. The limber has a splinter bar to which the traces are attached, and the shafts can be arranged for single, double, or treble draught.

The wagon consists of a body and limber, the latter identical with that of the gun. The body is composed of a framework of wood, having a *perch* passing down the middle, which hooks on to the limber pintail.

Four large, and two smaller centre boxes are carried on the wagon body, and there are platform and foot-boards

both in front and rear. A spare wheel is attached to a wooden axletree arm shod with iron, over the front foot-board and front platform board.

Wrought-iron
carriage, &c.
-pr. M. L. R.
Mark I.

Describe the 9-pr. M. L. R. wrought-iron field gun-carriage, limber, and wagon, Mark I.

The trail is formed of two bracket sides connected together by two transoms, two collar bolts, one rivet, and a trail plate; an axletree bed with axletree and light field wheels. Each bracket side is constructed of plate-iron, riveted to the outer side of a frame of angle iron. The *axletree bed* is of wrought-iron, constituting with the axle a beam of box-girder section; the axletree forms the bottom of the box, a piece of angle iron, riveted along each side of the body, the sides, and a plate of iron riveted upon the upper sides of the angle-iron pieces, the top. The bed is recessed into the brackets, and secured by being riveted to them, and also by bracket-stays in front and rear riveted to itself and the frames. The *trail plate* is formed of two jaws which project from an eye and embrace the points of the brackets; the eye is steeled to prevent wear by friction.

Elevating
screw.

The *elevating screw* is of the Whitworth pattern. It is attached to the gun by a bolt, and is worked by a metal nut through which it passes. Bevel teeth are cut upon the lower part of the nut, and into this a bevel wheel on a horizontal spindle gears. The nut is tapped with a screw inside, and the spindle is worked by a metal hand wheel. The nut and bevel wheel are contained in a box which oscillates on trunnions between the brackets.

The axletree boxes are made of deal, with ends of elm, and are fitted internally with mahogany. The lid serves as a seat, an iron step being provided for the feet of the men carried.

Limber.

The *limber* is formed of 3 futchells, an angle stay, a

splinter bar with two stays, a platform board, a footboard, an axletree bed with block and limber hook, an axletree, wheels same as gun, and a pair of shafts.

The *futchells* of tee iron are housed in and bolted to the axletree bed and to the splinter bar.

To support the ammunition boxes, 4 knees of tee iron are secured by screws to the back of the bed.

The *angle stay*, of angle iron, with plate-iron riveted to it, is riveted across and under the futchells, along the front of the bed, and gives rigidity to the structure.

The *splinter bar* is of plate iron, trough shaped, the ends being filled in with wood. It is bolted to the futchells, and connected with the bed by two stays of round iron.

The *footboard* is of elm, the *platform board* of ash.

The *axletree bed* is of elm, and the axletree is secured in it by yoke bands with coupling plates.

The *limber hook block* is of elm, and is secured to the bed by screws, the hook is of iron steeled, and has a steel key.

The *shafts* are of ash, the off shaft is of the Brandling pattern, with a "wheel iron" on the part between the splinter bar and axletree arm, which allows more room for mud to work through between itself and the wheel.

The limber is fitted for single, double, treble, or bullock-Draught. draught, as follows :—

For *single draught*, the near shaft passes through the Single. near splinter-bar band, the end entering a *stirrup iron* bolted to the left futchell, where it is secured by a bolt passed through the footboard. The off shaft passes through the *Brandling iron* on splinter bar, the wheel iron on its extremity fitting to an iron crutch on axletree bed, where it is secured by a linch pin.

For *double draught*, the off shaft passes through off Double. splinter-bar band, and its wheel iron fits on axletree arm.

9-pr. M. L. R. The near shaft passes through centre splinter-bar band, the
 Limber
 (continued). iron on its extremity entering a socket in axletree bed, where it is secured by a bolt through platform board.

Treble draught. For *treble draught*, the shafts are arranged as for single, and swingletrees hooked to the trace loops.

For *bullock draught*, a pole is fitted through the centre shaft iron, and draught chains lead from the V irons beneath the axletree bed to the yoke.

The near and off ammunition boxes are of deal, with elm ends, the centre box of deal, with mahogany ends.

9-pr. M. L. R. The wagon consists of a perch, two sides, two platform
 Wagon, Mark plates, one centre plate, two footboards, three platform
 I. boards, an axletree bed, axletree and wheels the same as limber.

The *perch* is of girder iron, with a steeled eye for the limber hook.

The *sides* are of angle iron, fish-bellied.

The *platform plates* are riveted across the perch, and the extremities of the sides. They serve to make the structure rigid.

The *centre plate* is riveted along the upper surface of the perch.

The *footboards* of elm, and *platform boards* of ash, are bolted across the perch and sides, the former being raised on elm brackets.

The *axletree bed* is of ash or oak; the perch and sides are housed across it and secured to it by bolts from knees riveted on them.

The block for spare wheel is of sabicu, and the stay on the perch of elm.

The ammunition boxes are of deal, with elm ends, and the near hind is interchangeable with the off front, and the off hind with the near front.

State the principal points of difference between Mark I. and Mark II. wrought-iron field gun-carriage, limber, and wagon. Mark II.
9-pr. M.L.R.
Carriage, &c.

(1) The trail plates are placed on the inner instead of the outer side of the bracket frame, thus giving greater strength to the bracket, by bringing the plate more under the trunnion. The brackets are housed over and riveted through their frames to the bed; they are also secured to it by the front transom which is riveted to them and the bed; and, further, by a small bracket stay between each bracket and the back of the bed.

(2) The trail piece is attached in a different manner, and the transoms are strengthened.

(3) The axletree beds of the limber and wagon are similar to those of the gun carriage.

(4) The futchells are secured to the bed in a different manner, and the limber hook is forged with 3 long arms, by which it is riveted to the bed of the wagon.

(5) The platform and footboards are wider, and a slat is secured beneath the latter and across the futchells to prevent a horse getting his leg between the splinter bar and the board.

(6) The perch of the wagon is somewhat similar to the trail, being formed of two brackets connected by a nose-piece.

(7) A stay of plate iron is riveted to the outside of each side, and to the axletree bed of the wagon.

(8) A platform plate is riveted across the perch and sides.

(9) The block for spare wheel axletree arm is of iron, with a wooden stay.

State differences between the 16-pr., Mark I. and II. carriage, limber, and wagon, and those of the 9-pr. 16-pr. M.L.R.
Carriage, &c.

The principal differences are, that the 16-pr. has heavy

instead of light field wheels (the tires of the former being 3" wide), the box of the elevating screw is attached by trunnions with cap-squares, and there is a box between the brackets of the trail to carry small stores.

Mark II. of the 16-pr. differs from Mark I. in the same particulars as the 9-pr. Marks differ from each other.

See **Axletrees and Wheels.**

Rocket
Wagon.

Describe the Rocket Wagon.

The Rocket Wagon only differs from the ordinary field Ammunition Wagon in the boxes being made deep enough to receive 25 Hale's rockets resting vertically in each box. It is fitted with three blocks of wood for the conveyance of the rocket trough. The limber has two boxes to contain 25 rockets each and one centre box to carry portfires, slow-match, tubes, &c.

S. A. Ammu-
nition Cart.

Describe the Small-Arm Ammunition cart.

The frame of the cart is formed by two sides and a summer of tee iron, bolted in rear to a cross piece of tee iron and in front to a splinter bar of plate iron. The frame is boarded over with deal and fitted with sides, head and tail board of the same. An arched canvas-covered roof is bolted to the sides and head board, and the interior is divided longitudinally into eight compartments each to contain two S.A. ammunition boxes. The tail board when up, keeps the box in position, and when down is supported by chains, forming a shelf on which to draw out the boxes. The splinter bar is fitted for double draught in the same manner as the field limbers.

Field Forge.

Describe the field forge. Mark II.

It is formed of a rectangular frame of angle-iron supported on 4 folding legs of angle-iron.

The *hearth* is of plate iron, and is fitted with a *fender*

round the front, and a semicircular *back* of plate iron hinged to the hearth so as to fold down or stand erect. The back is protected from the fire by a *back plate* of cast-iron and has at the reverse side a *nozzle plate* to receive the bellows, from which the blast passes to the hearth through a hole in the back plate. At the further extremity of the frame from the hearth a "rocking staff frame" is hinged for the support of bellows and rocking staff. An S hook connects the rocking staff to the bellows for use. The forge frame is fitted with 4 handles, and is secured in the wagon by two screws. The anvil is of wrought-iron faced with steel, the water trough of sheet-iron and is hung on the fender for use. The vice is fixed on the splinter bar of wagon when used.

The R.A. wagon which is fitted so as to carry the forge, R.A. Wagon and is also used as a store wagon, consists of a *body* and *fore-carriage*. The body consists of a framework boarded over to form a bottom and has movable sides, a head board and a tail board fitted to it. A locker is formed in front by a sliding partition, the lid of which serves as a driving seat. The body is supported over the hind axle upon two *side stays* of tee iron and a *cross stay* of round iron.

The fore-carriage is formed of four *futchells* housed in Fore Carria and bolted to a *splinter bar* and a *cross bar*. An upper of R.A. *bolster* is bolted over and an under *bolster* beneath the Wagon. centre of the futchells. A wheel plate for locking is attached to the upper bolster, to the cross bar, and to a small wheel bolster placed in front. The frame of the fore-carriage is supported over its axle in the same manner as the body over the hind axle.

The fore wheels are 3' 4" and the hind 5' 0" in diameter. It is fitted for either single or double draught.

The wagon is adapted to carry a spare fore wheel, entrenching tools, carbines and swords, stores and the *field forge*.

It is also fitted with two *floating raves*, formed each of three slight bars of ash the same length as the sides of the wagon, and attached to either side by iron brackets. The waterproof cover is placed over five *bale hoops* made of ash.

**Carriages,
Siege.**

Name the carriages employed with a Siege train.

Gun carriage.	Store wagon.
Mortar carriage.	Sling wagon.
Platform wagon.	Hand cart.
General service wagon.	Trench cart.
Siege wagon.	

**64 and 40. prs.
Carriages.**

Describe the wooden Siege carriage.

In general construction it is like a field carriage but it has two sets of trunnion holes, viz.—the firing and travelling holes; the piece rests in the former when in action but is removed to the latter when required to move any distance, in order to distribute the weight more equally and to keep the end of the trail down on the pintail. These carriages have block trails and no axletree boxes.

Limber.

The limber has a straight pintail bolted to a short block of wood in rear of the axletree bed. It has two pair of shafts one similar to that of a field limber and the other a pair of frame shafts fitting on to a long bolt attached to the splinter bar; at each end of the splinter bar is an iron *outrigger* which has a loop for a swingletree, and another for an iron stay to connect it with the drag washer on the axletree. By these means four horses can be harnessed abreast.

Block trail.

What are the advantages of the block trail?

- (1) The limber can carry a small quantity of Ammunition.
- (2) The carriage can lock round much closer.

(3) The wheels of the carriage and limber are of one height.

Describe briefly the iron Siege carriages for 40 and 64-prs. Iron Siege Carriages.
40-pr. M. L. F

The 40-pr. M.L.R. gun carriage is constructed in the same manner as the 9-pr. M.L.R., Mark II.

The trunnion holes are as in the wooden 40-pr. carriage, firing and travelling.

The gun is elevated or depressed by means of a rack attached to it, which passes between a pinion and a friction wheel upon the inside of the right bracket. The pinion is turned by means of a worm wheel and worm shaft with hand wheel inclosed in an iron box fitted over them on the outside of the right bracket. 35° elevation and 5° depression can be given to the gun.

The carriage is fitted with two trail handles, an iron box for a spanner, and rests for the elevating arc when the gun is in the travelling holes.

The limber is entirely of iron, made in the same manner as the field limber, Mark II.

The splinter bar is fitted for 4-horse draught as in the wooden siege limber.

The 64-pr. carriage is similar, the limber the same. 64-pr. M. L. I

In what respects does the 8" M.L.R. Howitzer carriage differ from the preceding? 8-inch Howitzer.

In having brackets of double plate construction with wrought-iron frames, and in the axletree and its bed, which is formed merely by a piece of angle iron riveted along each side of the axletree, passing through instead of lying beneath the brackets, while a bottom plate is added, extending from the rear transom to the breast of the brackets. This construction is necessary, as it is intended to fire the howitzers with the wheels off as well as on. The lower parts of the brackets are extended to the front.

8-inch Howitzer carriage
(continued).

to prevent the carriage tipping when the howitzer is fired with the wheels off, and the bottom plate is rounded in rear to prevent it injuring the platform. The elevating gear is worked at the left side, it is the same as 40 and 64-pr., but admits of 40° elevation. Limber same as 40-pr.

Mortar Carriage.

Describe the mortar travelling carriage.

The body consists of a bed, having an axletree let in underneath, and a perch in front which hooks up to the pintail of the limber: the bed has running-up bolts, and on each side an iron plate, which protects the ends and top, and forms a trunnion plate; the beds have ordinary capsquares.

When in battery, the wheels are removed, and the bed rests as usual on a platform.

Limbers.

The carriages of the 8-in. and 10-in. mortars have *shell cart limbers*, with battens and iron pins which can be adapted to the various sizes of shells.

The limber can carry

Six . . .	13-in. shells.
or Twelve .	10-in. „
„ Twenty .	8-in. „
„ Thirty-five	32-pr. „
„ Seventy-two	24-pr. (or 5½-in. mortar) shells.

7-inch B.L. Slide.

Describe the gun-carriage for the 7" B.L.R. gun.

It is the naval carriage fitted with slide plate compressors. The slide is the naval slide raised to a slope of 4° by a front and rear block, and fitted with a siege axletree in the rear block, with a hole for the pintail of a limber in the head, and with draught and keep chains.

For travelling, O.P. siege wheels are placed upon the axletree, and the front of the slide attached to a limber. In battery, the slide is unlimbered, the wheels removed, and the slide placed on a platform, to which it is pivoted by a fitting bolt in front.

What is the platform wagon ?

Platform
Wagon.

A wagon without sides, and fitted up by means of wooden brackets, either for guns, mortars, or their beds and gyns. It is capable of carrying one 10-in. mortar and its bed, or two 8-in. mortars and their beds, or a gun and its carriage.

Describe briefly the remaining carriages of a siege train. G.S. Wagon.

The *General Service wagon* is of ordinary construction, having a long body covered with waterproof canvas ; it is fitted for double draught, and will carry a weight of $1\frac{1}{2}$ tons, or take 20 powder cases.

The *siege wagon* is merely a G.S. wagon with movable Siege Wagon. trays for shot and shell.

The *store wagon*, by removing its internal fittings, will carry 16 powder cases.

The *hand cart* will take a load of 15 cwt.

Hand Cart.

The *trench cart* is a small cart with shafts for single draught. 10-in. and 8-in. mortars and their beds, as also the small brass mortars, can be transported in trench carts.

The *sling wagon* consists of a wooden frame and perch, the eye of which hooks on to a straight pintail on the limber ; it has a *windlass* over the axletree, worked by levers, for raising the gun or mortar, the trunnions of which are supported by iron *thimbles* and a *sling* of 6-in. rope.

The wheels are 7 feet in diameter, and the gun is slung underneath, muzzle to rear, the breech being lashed to the perch ; the carriage is carried over the perch. There are two heavier sling wagons, one of wrought-iron, with 8 feet wheels for guns of 6 to 12 tons, and the other of wood, with 11 feet wheels, for ordnance from 12 to 23 tons.

Name the three descriptions of Garrison carriages, and state the principles which should be observed in their construction. Carriages,
Garrison.

(1) Common standing. (2) Rear chock. (3) Sliding.

The following principles of construction are common to all garrison carriages :—

(1) The height of the carriage must depend upon the efficient working of the gun.

(2) The carriage must be easily run up or back, traversed, or moved from one embrasure to another.

(3) The carriage should occupy as little space as possible.

(4) The material must be capable of withstanding exposure to the atmosphere.

Common
Standing Car-
riage.

Describe the common standing carriage.

When made of wood, it is composed of two *brackets* connected together by a *transom*, two bolts one passing through the transom, and two *wooden axletrees*; it is mounted on four small iron *trucks*, the two front of larger diameter than the rear two; elevation is given by means of *quoins* and *elevating screw*, the latter supporting the *stool-bed*, upon which the quoins and breech of the gun rest. There are no capsquares.

Cast-iron Car-
riages.

A certain number of carriages are made of cast-iron, but they have the following disadvantages, viz., that they weigh more, they would be easily damaged, the splinters would be destructive, and if fractured, they are generally unrepairable.

Rear Chock.

What are rear chock carriages?

They are similar in construction to standing carriages, but have only two trucks in front, and instead of a rear axletree, a block of wood which rests upon the platform.

Sliding Car-
riage.

Describe the sliding carriage for dwarf traversing and casemate platforms.

It is also similar in construction to the standing carriage, but instead of axletrees it has two blocks, the part of the

blocks between the cheeks of the platform being deeper, so as to keep the carriage in its place.

Cheek plates, with gun metal trucks, are attached to the front of the brackets; the trucks come into play when the rear of the carriage is raised by *truck levers*.

A *preventer rope* is attached to the rear block, and being wound round the *bollard* of the platform, is held by one of the detachment, and regulates the forward movement when the carriage is run up.

The carriage is run back at drill by means of tackle, and the truck levers; a wood *compressor* is used to check the recoil after firing.

The casemate carriage is similar except that it has lower brackets.

What are wrought-iron standing carriages used for, and what is their general construction? Wrought-iron Carriages.

They are used in climates where wood is liable to decay for—(1) 64-pr. B.L. or M.L.R. guns, and 8" S.B.; (2) 32-pr. S.B. and 40-pr. B.L.R. They are constructed of open or *skeleton brackets*, each consisting of three *stays* of double plate-iron, bolted to a *tie beam* of tee-iron.

The axletrees are made of girder-iron, and two blocks of *sabicu* are screwed underneath the rear axletree, for use as a rear chock.

The trucks are elm, shod with iron ring tires; when not in use they are replaced by cast-iron ones.

1 and 2 are of similar construction but the brackets of the latter are four inches closer than those of the former.

Describe the wrought-iron carriages for heavy ordnance. Wrought-iron for heavy M. L. R. ordnance.
They are of two natures, *single-plate* and *double-plate*, and consist of the following parts, viz:—

- | | |
|-----------------|---------------------|
| 2 Brackets. | 4 Gun-metal trucks. |
| 1 Transom. | Elevating gear. |
| 1 Bottom plate. | Compressor. |

The bracket of a *single-plate* carriage is made of *plate-iron* riveted to a frame of *angle-iron* and strengthened with a centre stay of *tee-iron*. Four holes are cut through the bracket :—(1) For the breeching. (2) For the compressor screw. (3) and (4) For the spindles of elevating gear and friction roller.

The transom is made of plate-iron riveted to angle-iron. The bottom is of plate-iron, to the under surface of which are riveted two *guides* of angle-iron to fit in between the sides of the platform, and prevent the carriage from running off.

The trucks work in *iron flanged feet*, bolted to the brackets ; the rear trucks have eccentric axles.

Double-Plate
Carriages.

The *double-plate* differ from the single-plate carriages in the following respects, viz. :—

The brackets are made of two plates with a frame of *flat iron* between them, the whole being riveted together. The plates extend beyond the frame at the bottom, so as to form flanges for the trucks.

Instead of sockets for the rear trucks, a *connecting bar* joins the axles of the trucks which has a socket hole at each end for the shod levers, thus ensuring the trucks moving together.

A cleat of wood is bolted to the front transom, which comes in contact with four gutta-percha buffers on the platform, when the gun is run up, and so lessens the shock. There are also buffers to receive the rear of the carriage in recoil, on each side of the platform.

See **Compressor, Buffer, and Elevating gear.**

Baronades.

See **Smooth-bore.**

Cartridges.

Of what material is the service cartridge made, and of what shape ?

Of serge, secured with worsted ; serge is used in preference to paper or parchment :—(1) Because it packs better ;

(2) it is not so liable to leave sparks in the gun. Cartridges are made conical for ordnance with gomer chambers ; cylindrical for all other ordnance.

Of what materials are saluting cartridges made.

Saluting.

Of silk cloth, which is less liable to carry fire than serge. Their use is restricted to :—(1) Stations where the guns for firing salutes are less in number than the rounds to be fired.

(2) Garrison guns when fired at reviews.

(3) Garrison guns when fired for the dismissal of recruits.

How are cartridges packed ?

Packing.

(1) In metal-lined cases. (2) In barrels. (3) In ammunition boxes. *Metal-lined cases* are of three sizes :— *Metal-lined Cases.* Whole, half, and quarter ; they are rectangular boxes of wood, lined with copper ; they are closed with a circular metal bung, and a square lid screwed down by two bolts ; the bung is luted into its place when the case is full.

A whole case contains 120 lbs. powder in serge bags ; it takes all S.B. cartridges and rifle cartridges up to the 9", except P. powder ; the smaller sizes take respectively 60 and 30 lbs., and are generally used by the navy for small combustible stores, and S.A. blank cartridges. Metal-lined cases are used in damp magazines and in sieges.

Gun Ammunition Barrels are of two sizes, whole and Barrels. half, full bound ; four copper hoops ; staves of oak, or teak for tropical climates. They have round lids attached to the top by a copper hinge, and secured by a screw bolt. They are used in dry magazines ; the whole size will take all S.B. cartridges.

Ammunition Boxes are used for the issue of cartridges *Boxes.* to field batteries at home. They are marked with the nature and number of cartridges.

Zinc Cylinders.

Zinc Cylinders are used in the L.S. to contain the cartridges of the Woolwich guns. Each cylinder holds one cartridge, the 7-in. will hold two 14 lb. charges, or one battering charge. They act as cases in the magazine, and also serve to bring the cartridges up to the gun.

Cartridges for R. Ordnance.

What cartridges are there for rifled guns?

(1) Service cartridges. (2) Reduced. (3) Drill or dummy.

For (2), see **Reduced**.

B.L. Cartridge.

Describe the B.L. service cartridge.

It is made of serge, hooped with blue braid. With the 7", 40, and 20-pr., a paper cylinder is used to bring the cartridge up to length; the cartridge is half filled with powder, the cylinder is next inserted, so as to be in the centre of the cartridge, and then the rest of the charge.

See **Lubricator**.

M.L.R. Cartridge.

Describe the M.L.R. service cartridge.

There are two classes, battering and full. The first would be used with Palliser projectiles, and only under special circumstances with common shell; the second would be the ordinary charge used with common, double, shrapnel shells, and case shot.

The cartridges are hooped with blue braid and choked with worsted, and all, except the 20 lb. cartridge for the 8-in., and the full and reduced cartridges for the 7-in., have a serge becket over the choke for withdrawing them from the cylinders. Their diameters are greater when filled with P. than with R.L.G. powder; when the latter is used, the cartridge is to be made up to the required length by hooping the bags tightly.

Case Shot.

Describe the case shot for (1) S.B. ordnance; (2) B.L. ordnance; (3) M.L.R. ordnance.

(1) Case shot made for all S.B. guns, howitzers, and S.B. Case. carronades consists of cylinders filled with sand shot, the number and size of which vary with the nature of case, and the interstices between the balls are packed with shavings and sawdust. There are two natures for L.S., viz :—

Field Service case, of tin, with wood bottom, for 3, 6, 9, and 12-pr.

Land Service case, of tin, with one iron end, and a rope handle, for 18, 24, and 42-prs.

The case for a howitzer or carronade has smaller shot, and is lighter.

Case shot is very effective up to 300 yards, when the Use. enemy's front is considerable, especially if the ground is hard. It is chiefly used with Field Artillery and in the defence of works.

(2) For large calibres, the case is of sheet iron with B.L. Case. fringed edges, and has an iron bottom riveted to the lower fringe. A wrought-iron disc is placed inside the case at the bottom, and on this disc rest three sheet-iron curved plates, forming a lining. Filled with sand shot, packed in sand and clay, and covered with an iron top fringed and soldered down. The 7" and 64-pr. have an iron handle.

Small calibres have a tin case with tin bottom, an iron disc inside, and the bottom riveted on outside. They have a wood top, covered with tin, and rounded off to allow easy loading; the balls are of lead and antimony, packed in sand and clay. Both patterns have lead bands or studs at the base, to prevent their being rammed too far into the bore.

(3) The case shot for M.L.R. guns, above the 40-pr., M.L.R. Case are similar to the B.L., the studs being omitted, except in the 7" case, which answers for both B.L. and M.L. guns.

The 40-pr. and 25-pr. case resembles the field service

*M.L.R. Case
continued).*

more nearly than the higher calibres, but it has a wrought-iron top with handle attached.

The 8" case is used with the 8" howitzer with a charge of 10 lbs.

The field service case resembles that for B.L. guns except in having no studs; the disc and segmental linings of the 9-pr. are of zinc to avoid injury to the bore of the bronze gun. The later patterns have the tin cylinder made of 3 pieces soldered together, and a zinc ring riveted on to the outside of the bottom to strengthen it. Mark I. for the 16-pr. has 176 bullets. Mark I. for the 9-pr. has 110, and Marks II. and III. have 108 bullets. Mark IV. has iron instead zinc segments.

Range up to 450 yards.

See Projectiles.

*Requisites for
case shot.*

What are the requisites for a good case shot for rifled guns?

It is necessary to preserve the bore from the iron sand shot used in the larger natures, and to make the case sufficiently rigid, not to set up and expand, because if it does, the shot takes the rifling and scatters too much.

F.S. Case must be strong enough to stand knocking about in the limbers, and yet weak enough to open when fired with a small charge.

*Testing
shell.*

Why are common shell cast base downwards, and Palliser's base upwards?

Common shell are cast base downwards, as most strength is required there to resist the shock of the discharge. Palliser's base upwards, in order to obtain as sound a head as possible.

Centering.

What is meant by the term "centering" a projectile.

To "centre" a projectile is to cause its axis to correspond with that of the gun, and ensure its stability, so that the accuracy of the fire may be increased, and the wear of the bore decreased.

What means are adopted in our field guns to centre the projectile ?

A less inclination is given to the "driving" than to the "loading" side of the groove, so that when the shell is forced by the gas through the bore towards the muzzle, the studs rise up the sides of the grooves, and the projectile is thus centred.

What chambers are there in S.B. ordnance, and what are their advantages and disadvantages ?

The *cylindrical* and the *conical* or *gomer*. The only cylindrical pieces which have the former are the 24-pr. howitzer, the Coehorn howitzer, and carronades ; the advantage obtained is that, although a very small charge is used, a greater useful effect is derived from the powder ; the disadvantage is that, on account of the shot resting on the bottom of the bore, the gas acts more powerfully on the top of the shot than on the bottom, causing it to impinge strongly on the lower surface of the bore, thus producing a cavity which increases with every successive discharge, until the piece becomes much injured, not only at the seat of the first impact, but all along the bore by the successive rebounds of the shot as it passes through it.

All shell guns, mortars, 8-in. and 10-in. howitzers have Gomer. gomer chambers. The advantages are, that when the shot is *home*, all windage, until the shot has moved, is destroyed ; also, the axis of the projectile is in the same line as the axis of the bore, and the charge therefore acts uniformly on the projectile. Should the bore be horizontal, or nearly so, the shot will rest on the bottom of the bore, and these advantages will not be obtained.

What purpose does charcoal serve as one of the ingredients in gunpowder ?

Charcoal may be said to act the part of fuel, which combines with the oxygen of the saltpetre, enabling it

to burn, and in combining with it, forms an expansive gas.

If the charcoal be increased, the combustion is retarded; if decreased, the whole of the oxygen of the nitre will not be consumed, and the explosive effect will be greatly diminished.

See Gunpowder.

Give proportions of Charges to weight of projectile in different natures of ordnance.

Bronze S.B.	{	Guns, . .	$\frac{1}{8}$ to $\frac{1}{4}$
		Howitzers, .	$\frac{1}{4}$ to $\frac{1}{8}$
Cast-iron S.B.	{	Shot guns, .	$\frac{1}{8}$
		Shell guns, .	$\frac{1}{4}$ to $\frac{1}{8}$
		Howitzers, .	$\frac{1}{12}$
		Mortars S.S.,	$\frac{1}{10}$
		„ L.S.,	$\frac{1}{4}$ to $\frac{1}{2}$

With B.L. guns the proportion is about one-eighth.

With heavy rifled M.L. guns, as follows :—

Gun.		Service Charge.		Battering Charge.
7-inch	...	$\frac{1}{8}$	...	$\frac{1}{8}$
8 „	...	$\frac{1}{9}$	...	$\frac{1}{8}$
9 „	...	$\frac{1}{8}$	...	$\frac{1}{8}$
10 „	...	$\frac{1}{10}$	...	$\frac{1}{8}$
12 „	...	$\frac{1}{12}$	...	$\frac{1}{9}$

Why is a smaller charge used with a rifled gun than with a S.B. ?

In order to lessen the strain which is much greater with the same weight of projectile, and because the elongated projectile exposes less surface to the resistance of the air, and does not lose its velocity so rapidly as a spherical one.

What considerations regulate the amount of powder in the service charge ?

It should be such as to give the greatest I. V. to the projectile, without too great a strain on the metal of the

piece, or a too violent recoil of the gun, which would act injuriously on the carriage.

See **Gunpowder**.

What precautions must be taken in framing charges?

Charges
Framing of.

All crimes and offences must be stated in the charge, in a specific, and not a vague or indefinite manner. It must be shown that they are in breach of the Articles of War, and, although not necessary to specify the particular Article or Clause, for a breach of which the charge is brought, it is necessary to follow the wording as nearly as possible. All crimes and offences not specified in the Articles of War must be charged as being "to the prejudice of good order and military discipline," in accordance with the 105th Article. Each separate offence should be the subject of a distinct charge, although in cases of desertion, a single arraignment is sufficient for any number of instances.

A Garrison order is issued, forbidding soldiers to enter certain streets in the town: some soldiers are found in those streets. Frame a charge to meet the case.

Charge.—Conduct to the prejudice of good order and military discipline, in having at——, on or about the ——, been found in —— Street, thereby neglecting to obey a Garrison order.

Upon what charges should a soldier of the 120th Foot be arraigned, who, whilst on Furlough from the 1st to the 31st January, 1874, enlists on the 20th of that month into the 121st Foot, and on the 10th February enlists into the 122nd Hussars, receiving by the latter enlistment a free kit, value £5?

1st Charge.—Having on the 20th January, 1874, deserted from the 120th Foot, by fraudulently enlisting into the 121st Foot.

2nd Charge.—Having on the 10th February, 1874, deserted from the 121st Foot, by fraudulently enlisting into the 122nd Hussars, thereby obtaining a free kit, value £5.

N.B.—This man, being on Furlough, it is necessary to show the intention of not returning in the 1st charge.

~~See~~ Desertion, Perjury, &c.

Choice of Position.

In choosing a position upon the field for Artillery, what principles should be borne in mind?

That the guns should command not only the approaches to the weakest points, but also the whole of the ground within their range; that they should not inconvenience the manœuvres of the troops they support, and that they should be as far removed as possible out of the range of any place which could afford shelter for the enemy's infantry.

The fire of guns should always be concentrated or converging when practicable, such fire taking the enemy obliquely, covering a large extent of ground, leaving intervals for the movements of other troops, and entailing less liability to losses, from the dispersion of the enemy's fire. The position must afford facility for retiring, and guns should never be posted directly in front or rear of infantry, but be brought forward the moment they require to come into action. Should there be in front or on the flanks a sunken hollow, a wood, or village, guns must be placed to direct a fire on them. Guns of position should be stationed where the range is greatest, and should be protected by ditches, abbatia, or banks of earth, with a pit about 1½ feet deep in rear.

It is also necessary to consider the formation of the ground and the nature of the soil; the ground should be tolerably level, and should not have too great command over the space which the enemy must cross, as a plunging fire does little damage; the ground should not be stony, as the enemy's fire would make the stones fly in all direc-

tions; marshy ground is good in front of a position; undulating ground prevents the enemy from observing the effect of his fire, and so rectifying it.

See **Defence** and **Marshy ground**.

How is the choice of object for artillery fire in the field determined? **Choice of Object for Artillery fire.**

- At the commencement of an action, the fire should be directed wherever the distance, ground, and position of the enemy hold out the greatest promise of effect. Afterwards against those arms of the enemy whose resistance is most obstructive or advance most formidable. On the offensive, the fire is chiefly directed against the enemy's infantry or cavalry.

In an artillery duel, the best plan is for several pieces to be directed against one until it is dismounted.

See **Angle**.

**Clearance,
Angle of.**

See **Warrant for Clothing**.

Clothing.

Describe the process of coiling a bar for the manufacture of rifled ordnance. **Coils.**

The bar to be coiled, having the ends fastened down, is placed on trestle rollers, in front of a *reverberatory* furnace, a chain is hooked to the coil, and it is thus drawn out and wound round a slightly tapered roller or "mandril". The coil is next dropped off the mandril, and again placed in a furnace, where it is brought to a welding heat, after which it is placed upright under the steam hammer, and receives a few smart blows to weld the folds; it is then thrown on its side, and being gradually turned, is hammered all round to straighten it. A mandril, a little larger than the interior, is hammered down into the coil, which is hammered again all over, vertically and horizontally.

The coil is now replaced in the furnace for another heat.

ing, and much the same process gone through again to render it more consolidated and shapely.

Coils for C.I. Guns. *Why does strengthening cast-iron guns with wrought-iron coils fail, and why, to a certain extent, does Palliser's system of conversion succeed?*

It is inverting the theoretical order of things to place the stronger material outside, and even if the piece were sufficiently strengthened to bear the increased strain, the part near the vent, which is the weakest part of a cast-iron gun, would rapidly wear away, and cause the destruction of the gun.

On the contrary in Palliser's system, the principles of the method adopted are correct, as the strongest material is placed next the charge.

See **Principles**, and **Palliser**.

Commanding Officer. *What books are kept by the officer commanding a Battery?*

Order-book, day-book, ledger, defaulters' book, savings bank ledger, and horse-book.

Day-Book and Ledger. *What is the day-book, and what does the ledger contain?*

A book in which the regimental necessities and cash (except regular pay) received by each soldier are entered. The ledger contains the transcripts from the day-book, and shows on a separate leaf for each man his debit and credit account with the C.O., which is signed monthly by both.

Stores. *How are the stores in charge of the C.O. accounted for and the expenditure checked?*

A book is kept in which all issues to the artificers, and the purposes to which they are applied, are entered, and an annual store return, showing all stores on charge, all receipts, deliveries, and expenditure (with vouchers) is

prepared at the commencement of each year by the C.O., and audited by the War Office.

What information should an officer commanding a Battery operating in an enemy's country be in possession of, and how should it be acquired?

He should ascertain, by personal inspection, the most favourable positions for his guns. On the march he should reconnoitre the surrounding ground, woods, villages, &c., and on approaching a river he should ascertain the exact position of the fords.

See **Choice of Position.**

A Battery fires away part of its annual practice ammunition, and then changes its station, what steps must the C.O. take to draw the remainder at the new station?

When the C.O. returns the remainder of the ammunition at the old station, into store, he must obtain a voucher of receipt, signed by the Control Officer, and on the production of this at the new station, he will be entitled to draw a similar amount, in order to complete his annual practice ammunition.

Describe the common shell for S.B. ordnance: state the considerations which regulate the thickness of metal, and explain its use.

The common shell is a hollow projectile filled with powder, which is ignited by a fuze at the required moment, the bursting of the shell causing destruction by its explosive force, and by the fragments, and if the object be combustible, by setting it on fire.

The thickness of metal must be such that the bursting charge may be as large as possible, but the shell strong enough to withstand the shock of discharge.

It is fired from guns, howitzers, carronades, 5½" and 4½" mortars, and made of all calibres, from the 12-pr. to 10", except 100-pr., which has naval shell; with the mortars,

11. From
new A

12 and 24-pr. shells are used. Used against men in masses, houses, buildings, shipping, and material generally, either by bursting during flight, or at rest, when the shell acts as a mine. Particularly useful in the field when enemy is sheltered from direct fire, and in attack of villages and intrenched posts, as well as against cavalry to frighten horses and create confusion.

12. Common
shell.

Describe the B.L. common shell.

There are two classes:—(1) Garrison ; (2) Field.

(1) Shape cylindrical ; form of head ogival ; length about $2\frac{1}{2}$ calibres ; chamber lacquered to protect bursting charge.

(2) Similar, but has Armstrong field gauge, instead of G.S., with papier maché wad in fuze hole, which does not require to be removed, as the fuze will blow it out on acting.

13. M. L. Com-
mon Shell.

Describe the M.L.R. common shell ?

It is similar in construction to the B.L., except that the higher natures have extractor holes.

The 80-pr. shell is peculiar, in order to strengthen the the shell sufficiently to bear the strain of pressing in the studs ; it is cast with a band of increased thickness under the front stud ; the thickness of the shell increases gradually towards the base.

The common shells for the heavier natures have extractor holes in the head, and the interior lacquered. They are completely filled with powder, but bags are to be used. The gun metal bush is countersunk, except in the 40-pr. In all late manufactures, the bases are rounded off to facilitate loading. Shells made between '69 and '73 have unloading holes. The length is about three calibres, except that for the 12", 25 ton gun, which has an exceptionally *slow twist*, and takes a shorter projectile.

The field service shell has the G.S. wad placed in the fuze hole.

See **Projectiles.**

Describe the "wooden" compressor.

**Compress
ora.**

It consists of two cheeks of elm, held together by two guide bolts which are secured to one cheek, but slide easily in and out of the other. An iron *eccentric* is fitted between the cheeks in an oval hole; through this a square bolt passes, fastening it to an iron disc with two slotted holes, in which a small iron stud on each cheek works, and to a lever handle. The compressor is supported between the sides of the platform, beneath the carriage, by short iron plates.

When the lever is drawn to the rear, it presses the sides Action. of the compressor against the sides of the platform, by means of the eccentric; thus the compressor moves to the rear with the carriage, and the recoil is checked.

Used with 7" B.L., 64 and 80-pr. M.L.R., 10", 8", and Use. 68-pr. S.B., when mounted on sliding carriages.

*Describe the Elswick compressor for single-plate Elswick
carriages. Single-Plat*

Six movable bars of plate-iron are placed longitudinally on the platform. Seven plates, suspended from a bar in bottom plate of the carriage, hang down against these. The plates and bars are compressed together by *rocking levers*, worked by screw shafts, attached to levers outside the carriage.

The screws on the shafts are of different pitch, that on the right, which is called the *compressor shaft*, is quicker than that on the left, which is called the *adjusting shaft*. The levers work along arcs riveted to the carriage; the Action. requisite amount of compression is given by forcing the adjusting lever down, and keying it to the arc, the compressing lever being also pushed down and caught under a

Single-Plate projection on its arc. The compressor is made self-acting
(*continued*). by a *tripper* on the platform, which catches the end of the lever in recoil, and throws it into its compressing position.

Use. Used with single-plate wrought-iron carriages, but will be replaced by hydraulic buffer.

"American" Compressors. All Pattern I. carriages were fitted with the "American" compressor, which is similar to the above in principle. Five wooden baulks are used instead of iron plates, and the screw shafts are worked by wheels instead of levers.

Elswick Double-Plate. *Describe the Elswick compressor for double-plate carriages.*

It is similar in principle to the single-plate, but has the same shaft to work both rocking levers, whereby the strain of compression is transferred from the brackets of the carriage to the shaft itself. The compressing shaft passes from the right bracket of the carriage through the nut of the right-hand rocking lever, and into the nut of the left-hand lever; it has cut upon it a left and a right-handed screw thread, the former to work the right hand lever, and the latter to work the left hand. As the compressing lever is thrown down and the shaft turned, the nuts move from each other, and compression is put on by the lower ends of the rocking levers moving towards each other. When the compressing lever is thrown up, the nuts travel towards each other, and compression is taken off.

Construction of Ordnance. See B.L., M.L.R., Palliser, and Principles.

Courts of Inquiry. *Into what classes may Courts of Inquiry be divided?*
Into Five, viz. :—

- (1) For redress of wrong.
- (2) To enquire into cases of maiming.
- (3) To record illegal absence.
- (4) On officers taken prisoners of war.
- (5) Ordinary Courts of Inquiry.

What are they assembled for ?

To collect or record information, or to give an opinion upon a proposed question. Regimental Courts are generally assembled for the purpose of ascertaining whether there are grounds for submitting a case to a Court Martial.

Who may assemble them ?

They may be assembled by Commanding Officers of regiments, or by other still higher authority. In very important cases, Courts of Inquiry are sometimes assembled by order of the Sovereign.

Can an officer refuse to attend a Court of Inquiry assembled to enquire into his conduct ?

No ; but he may decline to take any part in proceedings, or to answer any questions, or make any statements which might be prejudicial to him.

Can the proceedings of a Court of Inquiry be produced in evidence before other Courts ?

Not without the consent of the officer who convened the Court, as their proceedings are privileged. A witness may be called to account, by military authority, for his statement, though a civil action could not be maintained.

Who signs the proceedings ?

Generally all the members, if a member disagrees with the general opinion, he can state his views separately.

State nature and powers of Courts of Inquiry to declare illegal absence of a soldier.

After the soldier has been illegally absent for 21 days, a Court of Enquiry of three officers is assembled, which examines witnesses on oath, respecting fact of absence, and deficiency, if any, of articles of kit ; they then declare him absent, and the period thereof, and the deficiency, if any, in the articles of his kit ; the commanding officer of

Courts of Inquiry (continued).

the soldier's corps, enters a record of the absence and deficiency of kit, and of declaration of the Court, in the regimental books. If the soldier does not afterwards surrender, or is not apprehended, such record has the legal effect of a conviction for desertion, and, if he does surrender, or is apprehended, such record, or a certified copy thereof, bearing the signature of officer in custody of the regimental books, shall, on the trial of such soldier for desertion, and making away with kit, be admissible as evidence, and on proof of the identity of the prisoner with the soldier therein mentioned, he may be found guilty of the charge or charges.

Courts Martial.
Persons amenable to Military Law.

Who may be said to be amenable to Military Law, and therefore liable to trial before a Court Martial?

Everyone in the receipt of permanent military pay.

Exceptions.

What are the exceptions to this rule?

Officers on half-pay cannot be tried by Court Martial except for offences committed when on full-pay. No recruit, or rather intended recruit is amenable to military law, until he has been attested or received pay.

Reserve Forces.

What is the rule with regard to the Reserve Forces?

The Mutiny Act does not extend to them. The Militia are subject to it during training and embodiment, and for 6 months subsequently, in respect of all offences committed during training and embodiment. Men under the Militia Reserve Act, 1867, when volunteering to be trained with the regular army, or when on army service, are subject to the Act; and at any time within 12 months after the offence has been committed, or the offender has been apprehended. The same is the case with men under the Army Reserve Act, 1867, who are also amenable to the Act when called out in aid of the Civil Power. The permanent staff of the *Militia and Volunteers* are at all times liable to the Act, as

also are volunteers when on actual military service, so far as the provisions of the Act relate to Great Britain. Yeomanry, when called out by reason of invasion or rebellion, or apprehension of invasion, and Pensioners when called out on duty to aid the Civil Power, or for muster or inspection, or when, having volunteered for that purpose, they are kept on duty in any fort, town, or garrison, are liable to the Act. Reserve Force
(continued).

What limitation is there to the punishment that can be inflicted upon Militiamen for offences during training?

It cannot extend to life or limb?

In case of men of the Militia, Volunteers, or Yeomanry having to be tried by C.M., what regulations are there as to the Officers composing the Court.

The officers composing the Court must be of the Militia, Volunteers, or Yeomanry respectively.

What limitation is there to the punishment that can be inflicted on men of the Yeomanry by C.M.?

It cannot extend to life or limb, except when the corps is on active service.

How long after the commission of any offence is a pensioner liable to be tried by C.M.?

After the expiration of 12 months from commission of offence, or of the apprehension of offender.

Can officers of the regular army sit on Courts Martial for trial of men of the Militia?

No.

What different natures of Courts Martials are there? Different
natures of
Courts Mar
tial.
General, and Detachment-General, District or Garrison, Regimental or Detachment.

vening
Confirm-

Who can convene, and who can confirm a General Court Martial at home, and who abroad?

The General in command of a district at home can convene it, but the Queen only can confirm it. A General in command of a station abroad may convene and confirm General Courts Martial, except in the cases of officers sentenced to any punishment from death to dismissal. In a colony, the General must obtain the sanction of the Queen's representative before any sentence of capital punishment can be executed. In India and China, the commanders-in-chief are given full powers to confirm capital sentences on officers or soldiers, they have also powers of delegation for the holding of General Courts Martial. The Commanders of Presidencies have similar powers, except in cases of sentences on officers from death to cashiering; such cases are to be referred to the General Commanding-in-chief in India.

Who can convene and who confirm a District Court Martial at home, and who abroad?

A General in command of a district at home can delegate to a Field Officer in command of four troops or companies, the power to convene, but not to confirm a District Court Martial; this the General can do by the terms of his warrant. A General in command of a station abroad can delegate to any Field Officer the power of convening a District Court Martial, but such Field Officer can only confirm the sentence of such Court if specially allowed to do so. In detached situations beyond seas, where a Field Officer is not in command, a Captain may be authorised to convene and confirm District Courts Martial. District Court Martial sentences cannot be put in execution till confirmed by the General Commanding, governor, or senior officer commanding the district, garrison, island, or colony.

Who may convene and confirm a Regimental or Detachment Court Martial? Convening and Confirming (continued).

The officer commanding a corps or detachment, provided he be not under the rank of Captain, except on board ship, when the officer in command, no matter of what rank, may convene and confirm a Detachment Court Martial.

Can a Court Martial be held on board a Commissioned ship?

No.

May the President of any Court Martial be the confirming officer, or the officer whose duty it was to investigate charge?

On no account, except in the case of a Detachment-General Court Martial, when the officer commanding the detachment may convene the Court, and appoint himself President.

What are the powers of a General Court Martial? General Court Martial.

The Court has the power of trying any one, subject to the Mutiny Act, for any offence, and of sentencing an officer or soldier to suffer death, penal servitude for not less than 5 years, imprisonment for not more than 2 years, or any other punishment according with the usage of the service.

Where would you find a list of offences which are especially cognisable by a General Court Martial? Offences.

Articles of War, 51 to 58.

Of how many members must a General Court Martial consist?

Of at least 9, 7, or 5 members, according to the station at which it is assembled. No officer so detailed to have

G.C.M. (*continued*). less than three years' commissioned service before the assembling of the Court.

Of what rank must the President of a General Court Martial be?

He must be a Field Officer unless a Field Officer cannot be obtained, when a Captain may be appointed. A General or Colonel is usually President of a General Court Martial.

District
Courts Mar-
tial.

What powers have District Courts Martial?

The same as General Courts Martial except that they cannot try Commissioned Officers or pass sentences of death or penal servitude.

What number of members are necessary?

Seven, five, or three, according to station, except in the case of the trial of a Warrant Officer, when the numbers are seven or five according to station, but not more than two members are taken from the regiment in which the prisoner is serving, and not more than two are to be under the rank of Captain—vide Art. of War, 111.

Offences.

Where would you look for the offences specially cognisable by District Courts Martial?

Articles of War, 59 to 69.

What rank must President hold?

That of Field Officer unless one cannot be had.

Regimental
Courts Mar-
tial.

What powers have Regimental Courts Martial?

They can give punishment of 42 days' imprisonment, a portion of such not exceeding 14 days at a time, with similar intervals between such imprisonment, may be solitary. They may also sentence offender to stoppage, to make good loss or damage—vide 130th Art. of War.

When can a Regimental Court Martial award corporal punishment?

On board ship not in commission and in the field.

Of what rank must President be?

Not under that of Captain, except on board a ship not in commission, on the line of march, or at any place where a Captain cannot be had.

When would a Detachment Court Martial be held?

In cases of Mutiny or insubordination accompanied with personal violence, or other offences committed on line of march, or on board ship. Detachment
Courts Mar-
tial.

What are its powers?

The same as those of Regimental Courts Martial.

Who may confirm and carry out sentence?

The officer in immediate command of the troops (not a member of the court) may confirm and carry out sentence on the spot.

What are the powers of a Detachment General Court Martial? Detachment
General Court
Martial.

The same powers of sentence as General Courts Martial have, but the sentence cannot be carried into effect until approved and confirmed by the General commanding the forces of which the detachment forms part.

For what are Detachment-General Courts Martial assembled, and by whom?

These Courts may be assembled by any officer in command of a detachment, on complaint being made to him of any offence committed against the property or person of any inhabitant of the country in which the force in question is serving. The object of such Court is to investigate the charge on the spot.

Detachment
G. C. M. (con-
tinued).

Of how many members must such Court consist ?
Of not less than three.

May Officers of Civil Departments be members of Courts Martial ?

Yes, but the President must be a combatant officer, no matter what the relative rank of the non-executive officers may be. They should not be put on Courts Martial if it can be possibly avoided.

When the General commanding a district or station decides to try an offender by a General or District Court Martial, what steps does he take ?

He directs the officer performing the duties of the A. G.'s department to give the necessary instructions for assembling the Court ; and in the case of a General Court Martial, if it occurs abroad, he appoints an officer to perform the duties of Judge-Advocate, a warrant signed by the General is addressed personally to the officer selected, the president of the Court is also similarly appointed by warrant.

The Court being assembled, what is the first duty of the members ?

To read over charge, and decide whether the Court is competent to deal with the case. If they consider charge is not cognisable by the Court, they adjourn and report to convening officer.

Objection to
President or
Member.

In case of an objection by the prisoner to the President or one of the members of the Court, what steps are taken ?

If objection is to President, and it be supported by more than one-third of the Court, it is allowed, and the Court adjourns for the decision of the officer who appointed President ; if the objection be to a member, the question is decided by a majority of votes, the President in this case being allowed a casting vote.

State what you consider would be valid grounds for objection on the part of the prisoner, to a member of his Court Martial.

That person objected to had been a member of a Court of Inquiry on charge, that he had been heard to express an opinion of the prisoner's guilt, that he had an interest in the case, if the person objected to were related to the parties concerned, if he were a material witness, or were the prisoner's C.O., and had taken an active part in bringing forward the charge.

What is done when the prisoner refuses to reply on the subject of objection?

The refusal is recorded and is considered tantamount to his having no objection.

Supposing that death reduce the number of the members of a Court below the legal number what happens?

Cases of sickness, or death of Members.

The Court is then practically dissolved; another Court must assemble and the proceedings be commenced *de novo*.

In case of sickness of members what happens?

The absence of any member during the reception of evidence, from sickness or otherwise, prevents his return—as long as a legal number of members remain, the trial may go on. If sickness reduce number below the legal minimum, the Court adjourns for a time, or a new Court is assembled.

What in case of the illness of the prisoner?

If illness is slight the Court adjourns until he is fit to appear again; if he becomes dangerously ill during the trial and not likely to recover for a considerable time, the Court may be dissolved, and he would be amenable to another trial.

Hours of
Sitting.

During what hours may Courts Martial sit ?

No proceedings can take place at home and abroad but between the hours of 8 A.M. and 4 P.M., except in India where hours are 6 A.M. to 4 P.M. If the Court consider it necessary they may continue any trial beyond the hour of 4 in the afternoon, recording in the Proceedings their reasons for so doing.

In what cases could trials take place at any hour ?

In cases requiring an immediate example, or when the General or other officer commanding any body of troops, shall certify under his hand, that the same is expedient for the public service.

Contempt of
Court.

How is contempt of Court dealt with ?

If the offender be an officer or a soldier, he incurs the penalty of being punished at the discretion of the Court, and if a civilian of being taken before a magistrate to be punished according to law—vide Art. of War 161.

Confirmation
and Non-con-
firmation.

If the sentence of a Court Martial be not approved, but confirmed, what is the legal effect ?

The same as if it were approved, except in the case of a Detachment-General Court Martial, which requires to be approved as well as confirmed.

What is effect if sentence be not confirmed ?

The trial is practically quashed ; the trial has not been completed, and therefore is not a trial at all, and where there is no trial, there can be no conviction, and no record thereof.

Cross.

What does a X on the gun-metal plug of a S.B. common shell mean ?

That the fuze hole is tapped throughout, so as to take Pettman's L.S. fuze.

State the means a prisoner is entitled to employ in order to rebut evidence brought against him of previous convictions. **Cross-examination.**

He can cross-examine the witness giving such evidence, or examine witnesses, or produce evidence.

What is meant by curved fire?

Curved Fire.

When a projectile is fired so as just to clear an interposing cover, and then descend upon the object, the line of fire being perpendicular, or nearly so, to the front of the troops or works fired at, such practice is termed *curved fire*, to distinguish it from *ricochet*.

Employed to dislodge troops posted behind cover, by firing common shells from guns or howitzers, and for breaching covered revetments. Smaller charges and higher angles would be required than for ordinary direct fire.

Explain the operation of "cutting" a gun.

Cutting.

To *cut* a gun is to cause it to move horizontally without rolling, by moving breech and muzzle alternately in the required direction.

Heavy guns, up to 12 tons, can be cut by a lever placed in the bore.

The skids, on which the gun to be cut rests, should be close under its C. of G.

The end of the gun opposite to that to be moved should be scotched up.

D.

... *position. How should*

... *cross fire on*
... *being placed in*
... *of those*
... *and in*
... *of assembling*
... *The*
... *the most advanced*
... *from them if re-*

... *of a*

... *all the ap-*
... *being deter-*
... *The*
... *with the*
... *in the surrounding country.*
... *and*
... *in the night of his*
... *and shrapnel*
... *where the working*
... *discover*
... *the enemy's*
... *When the assailant's*
... *the should be*
... *the*
... *the*

advance, by a new disposition of the flank defences. Grape and case may be employed with great advantage, and the guns should be disposed so as to cross their fire on the glacis. If the fortress is to be abandoned all the ordnance and stores should be rendered unserviceable.

What is the meaning of "Deflection"?

Deflection.

The perpendicular horizontal distance right or left, of the first graze, or of the point of impact on the object, from the plane of fire.

See **Elevation.**

How would you find the "Mean Deflection" of a projectile? **Mean Deflection.**

Add together separately all the right deflections and all the left deflections: subtract the smaller sum from the larger and divide the difference by the number of shot fired.

What is the "Mean Reduced Deflection"?

Mean Reduced Deflection.

Find the distance of each deflection from a line passing through the mean deflection; add these distances termed "reduced deflections" together and divide by the number of shot fired for the "mean reduced deflection".

See **Angle.**

Departure angle of.

What is the "Derivation" or "Drift" of elongated projectiles fired from R. guns? **Derivation or Drift.**

It is a peculiar deviation of the projectile to the right or left according as the rotation is right-handed or left-handed.

How would you explain it?

Two reasons have been assigned—(1) That a projectile Cause of Drift rotating rapidly, and at the same time falling in the air will experience a greater pressure underneath than above, and will roll as it were on the denser air below. (2)

Desertion
(continued).

Desert
Inter
mes

According to Professor Baskin. "The shot will have a sidewise motion. But as the effect of an ogival-headed shot spinning from right to left is to the right, and afterwards as the shot is directed more to the right than to the left, the shot will have a deviation on the whole greater to the right than to the left."

How is the tangent of the barrel of the R. Gun?

The tangent will be to the left in the gun at an angle, varying with the nature of the gun.

See Angle.

Desert
Inter
mes

What is desertion?

Desertion is the illegal desertion of an officer or soldier from his duty without leave or returning.

Desert
Inter
mes

Desertion
Inter
mes

What course should be taken if a soldier confesses himself to be a deserter?

His confession, signed by the C.O., is entered in the regimental books. If proof cannot be conveniently obtained, the soldier is to continue home duty until discharged, or till legal proof of the truth or falsehood of such confession is obtained. He may then be tried for desertion, or for making a false statement to his C.O., as the case may be.

What power has the Commander-in-Chief, or other officer commanding at any foreign station, with reference to a soldier confessing desertion?

He may order such soldier to serve in any regiment or corps, but the soldier in such a case forfeits his service between the date of his confession and the date of the said order to serve; also he forfeits all G. C. pay and pension on discharge, resulting from past services, and all medals and decorations, and any annuity or gratuity appertaining thereto.

May a soldier be tried for several desertions at once?

Yes.

See **Charges.**

When a man has been absent twenty-one days, and a Record of Court of Inquiry record his illegal absence, what effect has that record in the event of the man subsequently surrendering, or being apprehended?

The record of the Court of Inquiry, or a copy thereof, purporting to bear the signature of the officer having the custody of the Regimental Books, shall be admissible as evidence on the man's trial, with regard to the facts recorded in the declaration of the Court of Inquiry, and on the proof of the identity of the prisoner with the soldier therein mentioned, he may be found guilty of the charge.

Can a deserter be tried by Regimental Court Martial?

No. He can be tried for absence without leave, over 21 days, by the special permission of the General commanding.

See **Shrapnel.**

Diaphragm shell.

Under what circumstances can a soldier obtain his discharge from the service?

Discharge Soldiers.

No man can claim his discharge as a right until the expiration of his engagement, previous to which he can be discharged, only for one of the following reasons:—

- (1) On account of unfitness for further service.
- (2) In consequence of reduction of military establishment.
- (3) As an indulgence, by purchase, or free, under conditions hereafter stated.
- (4) Consequent on the sentence of Court Martial to dismissal with ignominy.
- (5) Summary dismissal, viz.:—For incorrigible con-

duct ; on conviction by the civil power of felony or disgraceful offences ; on being sentenced to penal servitude.

discharge by
purchase.

Give the scale for "discharge by purchase," applicable to men enlisted after December 27, 1870.

SCALE "III." from Army Circular 63 of 1873.	Horse Artillery (except Drivers) and Artificers R. A.				R. A. (except Artificers) and Drivers R. H. A.			
	No Badge.	1 Badge.	2 Badges.	3 Badges.	No Badge.	1 Badge.	2 Badges.	3 Badges.
Under 6 months' service,	£ 25	£ ...	£ ...	£ ...	£ 20	£ ...	£ ...	£ ...
Between 6 months and } 6 years, and Boys... }	35	33	...	...	30	28	...	...
After 6 years' service.....	31	29	26	...	26	24	21	...
„ 8 „ „ „	28	26	23	...	23	21	18	...
„ 10 „ „ „	25	23	20	...	20	18	15	...
„ 11 „ „ „	22	20	17	...	16	14	11	...
<i>After re-engagement or re-enlistment, includ- ing former service.</i>								
Under 11 years' service...	34	32	29	...	29	27	24	...
After 11 „ „ „ ...	25	23	20	...	21	19	16	...
„ 12 „ „ „ ...	22	20	17	14	18	16	13	10
„ 13 „ „ „ ...	20	18	15	12	16	14	11	8
„ 16 „ „ „ ...	10	8	5	Free	8	6	3	Free
„ 18 „ „ „ ...	5	2	Free	Free	3	Free	Free	Free
„ 19 „ „ „ ...	Free	Free	Free	Free	Free	Free	Free	Free

In addition to this scale, there are Scales "I." and "II.," which are slightly different. Men enlisted prior to July, 23, 1864, may purchase their discharge according to Scales I. II. or III., as they elect. Those enlisted prior to December, 27, 1870, according to Scales II or III See *Army Circular 63, of June, 1873.*

Define the term "Dispart".

Dispart.

The Dispart is half the difference of the diameters of the base ring and the swell of the muzzle, or half the difference between the diameters of those parts of the gun upon which the sights are placed.

What are double shell, and from what guns are they fired?

Double shell.

Double shell resemble common shell, but are longer, being generally about 4 calibres in length, and strengthened internally with three ribs. They are fired from the three 7-inch M.L.R. wrought-iron guns, the two 7-pr. M.L.R. bronze guns, and the 7-pr. M.L.R. steel gun of 200 lbs.

For what are they used, and how fired?

Use.

They are chiefly used, with the 7-inch gun, for firing at wooden ships, at a high angle and with reduced charges, the shell having a large bursting charge. The 7-pr. double shell would be effective against houses.

What are the relative advantages and disadvantages of the shafts and pole for field carriages?

The great advantage of shafts is that the carriage is much more under control, for manœuvring and turning. In crossing a ditch or depression in the ground, the pole is very liable to bear down on the horses when they are attempting to ascend on the opposite side. On the other hand, in stopping the carriage, or in going down steep hills, the pole distributes the weight more over the two horses; when shafts are used, the weight comes mainly on the shaft horse, which must therefore be a very powerful one.

See **Carriages and Traction.**

What is a Drug?

Drugs.

A carriage, consisting of a platform on four trucks, for transporting ordnance, &c. Drugs are constructed of the

Drugs (*continued*).

following 5 natures, viz. :—Small, medium, large, gun drug to five tons, and gun drug to 25 tons. The two first are fitted for man draught; the large drug with frame shafts for double draught; the five ton for single draught, and the 25 ton, with two pairs of frame shafts and *outriggers*, for four horses abreast.

Ductility.

Define the term "Ductility".

Ductility is the property of permanently extending, or drawing out by traction, as in wire drawing.

E

What is the general construction of earth works?

Earthworks.

The minimum height should be about 8 feet for all well-finished field works. To shelter infantry on the defensive, (but who are to act offensively when opportunity occurs), a bank of earth, 3 feet high, with a base of 8 or 9 feet, having a trench on each side, 5 feet wide by 1 ft. 6 in. deep, and a berm of 1 foot on either side. For redoubts, &c., the banquette should be 3 feet for single, or 4 ft. 6 in. for double rank : slope to it, $\frac{1}{2}$: interior slope, base 1 ft. or 1 ft. 6 in. : superior slope, $\frac{1}{3}$: exterior slope, 45° : berm, 2 ft. : ditch, from 6 to 12 ft. deep : parapet, 10 to 12 ft. along superior slope.

Give general rules for construction and garrisoning of square redoubts.

Redoubts.

Sides not less than 20 or more than 50 yards ; profile as above. An allowance of 500 feet for each field gun, and same for entrance traverse ; remaining superficial area, calculated in square feet, within foot of slope of banquette, divided by 20, will give maximum garrison. Minimum garrison for minimum size, 80 men ; maximum for the largest square redoubts 400, with 4 field pieces.

Obstacles, such as felled timber, with leaves and small branches stripped off, and the others pointed, wire fences, wire entanglements, &c., should be employed ; if possible, they should be screened from the enemy, but should be under musketry fire.

Obstacles.

Define the term "Echelon".

Echelon.

Echelon is when a line of troops is broken into several parts, moving direct to the front or rear in succession.

echelon (continued). Oblique echelon is when the divisions of a line wheel less than a quarter circle, so as to be oblique to the former front, and parallel to each other. Short echelon is formed by the two centre companies advancing, and the remaining companies of half battalions following in succession at six paces distance.

elasticity. Define "*Elasticity*".

Elasticity is the property in virtue of which bodies resume their original form or volume when the force which altered that form or volume ceases to act. It may be developed in bodies by pressure, traction, flexion, or torsion.

elevation. What is the rule for correcting errors in *Elevation and Deflection*?

For elevation, the rule is, that up to 500 yards, 1 minute of elevation makes a difference of 10 yards in range; from 500 to 1000 yards, 7 yards; from 1000 to 1600, 6; from 1600 upwards, 5. Increasing the elevation increases range, and *vice versa*.

For deflection, the rule is—Reduce the error to inches, and divide by number of hundreds of yards in the range.

Example—A projectile fired at 1400 yards range falls 50 yards short, and 4 feet to the right of the object—Find corrections for elevation and deflection:—

1. Elevation must be increased $\frac{50}{6} = 8$ minutes.

2. Deflection would be $\frac{4 \times 12}{14}$ minutes = $\frac{48}{14} = 3$

minutes left.

line of Metal Elevation. What is the "*Line of Metal Elevation*"?

When a gun is laid upon an object by means of the line of metal (there being no dispart patch), that is when the notches on the highest part of the base ring and swell of the muzzle and the object are all in one line; the ele-

vation thus obtained is called the "Line of metal elevation". It varies in different S.B. guns from 1° to $2\frac{1}{4}^{\circ}$.

See **Angle**.

What means are there of giving the required elevation or depression to ordnance without using sights?

By employing Quadrants.

See **Quadrants**.

How is the impulse on the elevating screw influenced by the position of the trunnions? **Elevating screw.**

It increases directly as the distance from the centre of the trunnions to the axis of the bore, and inversely as the distance from the centre of trunnions to the elevating-screw. See pp. 24 and 26.

Describe the elevating gear for wrought-iron sliding carriages? **Elevating gear for wrought-iron carriages.**

The elevating gear is fitted on each bracket, and the gun moved by working both sides simultaneously. On each side it consists of—

A wrought-iron elevating arc.

A pinion fixed to a spindle of wrought-iron.

A metal friction roller attached to an iron spindle, with metal nut and steel pin.

A capstan head of wrought-iron.

A jamming lever of wrought-iron.

The elevating arc is pivoted to the gun and passes on the inside of the bracket, between the friction roller and the pinion; it has teeth upon the rear edge, which gear in the teeth of the pinion, and a groove on the front for the roller to run upon, so that the latter not only keeps the arc in gear with pinion, but prevents it moving from the side of the carriage. The spindles of the friction roller and pinion pass through metal bearings in the bracket, the former is secured by a metal nut and steel pin, the latter has upon it the capstan head and jamming lever. The

capstan head has a boss upon the inner side, which keeps it clear of the rivets of the carriage, and holes in its circumference for the iron-pointed lever by which it is turned. When thus moved, it turns the spindle, as it has feathers on it which enter slots in the latter, and the spindle by its pinion moves the arc. The jamming lever screws upon the spindle outside the capstan head, so that when tightened upon the latter it clamps the pinion. The thread of the spindle on the right bracket is left-handed, and of that in the left bracket right-handed, so that both the jamming levers clamp by turning to the rear.

State the method of embarking artillery when not in the presence of the enemy.

The guns, carriages, and harness are first embarked, then the horses. On arrival of battery at place of embarkation, the horses are taken out, the harness taken off and packed in vats, and the stores in cases; intrenching tools remain with carriages. The gun detachments strip the carriages of everything movable; the gun is unlimbered and dismounted. The carriages and gun are placed in the ship by means of a crane if ship is moored to a wharf, or taken in boats when out at sea. Every article must be stowed away, so as to be got at without delay, and those articles required last on disembarkation must be put on board first. Spare carriages and forge stowed forward, left division next to them, and before main hatchway; centre division, abaft hatchway, right division, under hatchway. Guns together in bottom of hold, vents downwards. Horses embarked in the same order as carriages, and divisions to be kept together as far as possible.

What are arrangements when a battery is embarked in different ships?

Every part should be complete, and a proportion of general stores be on board of each.

What precautions are necessary with regard to the Ammunition ammunition in case of a voyage lasting several days ?

The cartouches with the ammunition must be taken out of the boxes and stowed in the magazine. The ammunition must be so placed, that whatever part belongs to any particular carriage may be got at without difficulty. When the cartouches are not taken out, the boxes must be stowed well aft in the hold, or between decks, and they should be well covered with wadmiltits or hair-cloths.

How are the horses put into the ship ?

Horses.

When embarked from a wharf they are hoisted in by sling and tackle. When from an open beach they are led to the boat by a halter, and made to walk or leap into it ; the quietest horses being embarked first.

How is a horse slung ?

Slinging.

Four men, besides the driver are required to sling him, one on each side, one at his breast, and another behind. The driver holds his head, the sling is then placed under the horse's belly, and the two ends brought together over his back ; one man passes his loop through the other, it is received by the man on the other side who hauls it through, hooking the tackle to it, both men holding up the ends of the sling. The guys are made fast to the horse's head, and he is hoisted on board, sling taken off, and the horse led to his place.

What course is adopted when embarking in presence of the enemy ?

Embarking
before enemy

The horses and carriages should be first embarked, the guns being retained to the last to repel any attack. If the position be a mile or two from the place of embarkation, it would be necessary to retain a portion of the horses.

What is the process of disembarking artillery ?

Disembark-
ation.

It is just the reverse of that of embarking. The har-

ENCAMPING.

Elevat.
tion (in
timed),

... sent on shore. In disembarking
... the guns should be placed in
... of the gun pointing forward,
... the gun.

... depth and breadth required for a
... encamped by sub-divisions at half

... : breadth, $66\frac{1}{2}$ yards.

... of general principles to be observed in
... a standing Camp—1st, from a military,
... sanitary point of view?

Embarl
ation.

... should be selected which is not com-
... cannot be turned, and which, as far as
... demands and surrounds the neighbouring posi-
... need not be necessarily on the line of march
... division is following, it may, with advantage,
... distance on either side.

... for obtaining water, wood, forage, and
... is better to be within a moderate distance of
... to be too close to it, as it is most important
... not be polluted. The site should be sandy or
... and dry, and the ground should, as a rule, slope
... or East. Wet ground to be avoided as much
... and the site ought never to be in a wood.
... to encamp on; newly-ploughed ground and
... unless soil is gravelly or sandy, is bad as also
... and water courses.

... principles are to be observed when encamping; for
... in presence of the enemy?

... reasons must be all important, the sanitary
... having to give way to them.

... are the principles which guide the formations of
... used by us?

(1) The front of the camp should correspond in extent with the front occupied by the force when deployed in line.

(2) The means of passing freely through the camp, with a large front, should be maintained.

(3) The tents, bivouacs, or huts should be disposed with a view to the greatest amount of order, cleanliness, ventilation, and salubrity.

(4) The camp should be as compactly arranged as the above considerations permit.

Describe generally the encampment of a battery of Artillery in line, at half interval. Artillery Camp.

The battery is marched on the alignment at half interval, the horses being halted when the leaders' heads are on the alignment.

The picket lines are laid $9\frac{1}{2}$ yards in rear of the tail-boards of the last line of carriages, and in line either with the off or near wheels, according to the direction the horses are intended to face. On each side 6 tents are pitched for the sub-divisions, doors facing inwards; the first tent on either side has its centre (when there is sufficient room) $9\frac{1}{2}$ yards to the rear, and an equal distance to the flank of the flank carriage, the others $9\frac{1}{2}$ yards distant from centre to centre. If there is not sufficient depth, the tents may be advanced until the first on either side has its centre in line with the points of the shafts, still $9\frac{1}{2}$ yards distant. The guard tent is pitched 19 yards in front of the half interval between 3 and 4 sub-divisions. Every distance between guns, carriages, picket lines, tents, &c., is $9\frac{1}{2}$ yards, or half an interval, except that between the men's tents and the officers, which, for convenience, are pitched a full interval or more distant from the rear sub-division tents on either side; they are pitched, facing inwards, and covering the centres of the half intervals between sub-divisions, or the picket lines, according to their number.

Robert Frost
may there
of May.

[illegible]

follow Nos. 3, 5, and 7 of their own sub-divisions, hand them a mallet and 5 pegs each, shake out their tents and stretch them on the ground, door uppermost, tops outward, except the guard tent which will be top inward. Pole numbers, when dressed, turn inward at the word "*Eyes front*," and drive each a peg into the ground, upright between their feet, dropping their poles to the front at the same time. Each number then takes $3\frac{1}{2}$ paces to his front, rear, right, and left, driving a guy peg at the end of each pacing. The 2 tent Nos. will then draw the tent on to the ground it is to occupy, taking the 2nd rope from each side of the door, and placing them on the front peg at full length, the 5th rope on each flank guy, and the 5th rope from that on the rear guy peg. Each odd No. then places tent pole in grummet of tent top, and prepares to raise the tent. The tents are all raised at once by order or signal. Even Nos. then tighten guy ropes, and all the Nos. peg down all round.

The Guard tent is pitched in the same manner, 19 yards in front of centre of battery, by Nos. 7 and 8 of **3** sub-division, door to the front. Nos. 7 and 8 of **4** sub. assist to dig cooking trench.

Nos. 9 drive the 1st picket post where placed by Nos. 1; the 2nd and 3rd posts $9\frac{1}{2}$ yards apart, parallel to line of tent poles, and covering the wheels. The picket lines are fixed by these numbers, assisted by Nos. 2 and centre drivers.

Picket lines for officers' horses to be placed $9\frac{1}{2}$ yards from sub-division lines, parallel to front and rear of camp.

The horses, having been unhooked, will be filed on the lines when ordered.

The subaltern in charge of right division superintends the dressing of the right-half battery.

The subaltern of left division, the dressing of left-half battery.

The subaltern of centre division, the officers' tents.

The captain and sergeant-major, the picket ropes.

Energy.

What is the "Energy" of a projectile, and how is it calculated?

The energy is the stored-up work in the shot at the moment of impact. It is calculated by the formula;

$$\text{Work or PS} = \frac{wv^2}{2g}$$

Where w = weight of projectile in lbs.

v = final velocity in feet per second.

g = force of gravity (32.2 feet).

How are the punching effects of projectiles, fired at an iron target, usually compared, and what is the formula?

By calculating the *energy per inch of circumference* in foot tons, which is found by dividing the *total work or energy* of the projectile by the number of inches in its circumference.

$$\text{Energy per inch of circumference} = \frac{wv^2}{2g \times 2\pi \cdot R} \text{ where}$$

R = radius of shot.

N.B.—To get the result in foot tons, w = weight of projectile in fractions of a ton.

Enfilade fire.

What is Enfilade fire?

The fire obtained when a battery is placed perpendicularly to a line of troops or works, the guns being fired with the full service charge.

Enlistment.

What is the term of enlistment for the R.A.?

The 1st term of enlistment, or limited engagement, is for 12 years service in the Royal Artillery, or for 8 years in the R.A., and 4 years in the Reserve, according as the recruit may desire. After the 12 years are completed in the R.A., the soldier may re-engage, so as to make up 21 years for pension, under certain conditions.

See **Re-engagement**.

What are the regulations with reference to the enlistment of recruits?

A recruit is deemed to be enlisted when he receives the enlisting money. He must be brought before a magistrate within 96 hours (Sunday, Christmas Day, and Good Friday excepted), but not sooner than 24 hours, to be attested ; if he then repents of his engagement, it may be cancelled on payment of 20s. smart money, repayment of enlisting money, and any other pay or allowances received. If he desert after attestation, but before joining, he forfeits any bounty he may have received, and is liable to be transferred to any regiment, but is not liable afterwards to any further punishment. After he has received pay for 6 months, and has been on the strength, he cannot have his enlistment cancelled by any plea of illegality or error.

Where would you obtain a correct list of stores, &c., if Equipment ordered to draw an equipment ?

In "Revised Army Regulations," vol. III., Part I. "Corps Equipment"—(amended, April, 1874).

State the object of having escorts for batteries in the field. Of what are they composed, and how employed ?

Escorts are furnished to batteries in the field to protect Use. them from sudden attack ; to reconnoitre a position proposed to be taken up by the battery ; to ascertain the presence of the enemy, any ambuscade, &c. They are to Composition consist of never less than a troop of cavalry or a company of infantry, and are under the direction of the officer commanding the battery. In open country, cavalry would be best employed ; and in hilly and wooded country, and when acting on defensive, infantry.

How should the escorts move ?

Position.

They should be a little in rear of both flanks, or of that flank most exposed to attack when taking up a position, halting about 100 or 200 yards to the rear, and should take advantage of any cover. In returning, they should

Position of
Escorts (*con-
tinued*).

allow the guns to pass them, and follow in rear on the flanks. In wooded positions, they should skirmish in front and patrol the ground.

Evidence.

What is Evidence?

The term "Evidence" includes all the legal means, exclusive of mere argument, which tend to prove or disprove any matter, the truth of which is submitted for investigation.

Rules of
Evidence.

What are the "Rules of Evidence"?

(1) The evidence on either side must be confined to the points at issue.

(2) The burden of proof rests with the party who makes the assertion.

(3) It is sufficient to prove the substance of the charge.

(4) Hearsay is not evidence.

(5) The best evidence must be procured which the nature of the case will admit of.

Hearsay
Evidence.

Define "Hearsay" evidence.

Hearsay is the statement by a witness of facts that do not lie within his own knowledge, but which are derived from the oral or written information of others.

Exceptions.

What exceptions are there to this rule?

Dying declarations are admissible as evidence, for or against the prisoner, in cases where the death of the person concerned is the subject of the charge.

The declaration of a person robbed, as to the fact, when made immediately afterwards, is admissible.

The evidence as to what a third person has said or written, may be admissible when the question is merely as to whether the matter was said or written.

Are confessions by prisoners admissible as evidence?

Yes, but they must be received with caution ; to be worth anything, they must be entirely voluntary.

What is the difference between the rules for evidence as to character before Civil Courts and before Courts Martial ? Evidence as to Character.

Before a Civil Court, evidence as to character must bear directly on the charge. Before a Court Martial, the prisoner is usually allowed to bring forward any evidence as regards character that may tell in his favour ; such evidence is worthless *as evidence*, unless it have direct reference to the nature of the charge at issue, but it might influence the Court or Confirming Officer as regards the amount of punishment to be inflicted, though, of course, it could not influence the finding of the Court.

What is a "Memorandum of Examination" ?

A document sent with a gun when it is passed into the service, containing information as to the material of the bore, a short description of the construction, and a wood-cut showing the gun in section. The defects in the gun at the time of its issue, the number of rounds it has fired, and the subsequent examinations, are also stated.

See **Flaws**.

Examination. Memorandum of.

F.

Field Artillery. See **Armament, Carriages, Choice of Position, C.O., &c., &c.**

Filters. *How would you construct a filter from two barrels of different sizes ; (1) when the source of the water is above the barrel ; (2) when it is a small spring gushing out of the ground ?*

(1) Set the larger barrel upright, with the top out, put a layer of sand in the bottom, above that a layer of charcoal, and above that again a layer of coarse gravel, the whole about $\frac{1}{3}$ the depth of barrel. The smaller barrel, with the bottom removed, is placed inside the other, so as to rest on three stones in the sand. The water flowing or being poured into the space between the two barrels, and having to force its way through the layers into the inner one, becomes purified.

(2) The outer barrel in this case must have the bottom perforated with holes ; the inner one with the bottom in, and being pierced with holes round the sides near the top, receives the water after it has risen through alternate layers of moss, sand, charcoal, and coarse gravel.

In both cases the water is drawn off by means of a pipe passing through the centre of both barrels.

Fines. *Give the Scale of Fines for drunkenness ?*

(a) First and second acts, admonition or C.B.

For every subsequent act :—

(b) If within 3 months of second act, 7s. 6d.

(c) If over 3 and within 6 months, 5s.

(d) If over 6 and within 9 „ 2s. 6d.

(e) If over 9 and within 12 „ company entry.

(f) If over 12 months, to be treated as first act; but for a second subsequent act, fine according to scale.

(g) When four preceding acts occur in 12 months, 2s. 6d. to be added for every subsequent act within that period.

State rules for levying fines.

Rules.

They are to be enforced by a daily stoppage; when fine amounts to 10s., or when a second one has been incurred before a former one is paid, the stoppage is 4d.; but it is never to be less than 3d. Fines for a second offence, whilst under stoppage, to commence after first has been paid.

In what case can a soldier appeal to a Court Martial?

Only when he denies the offence.

Appeal
against Fine

What is meant by Horizontal fire and what by Vertical?

Fire from
ordnance.

Horizontal fire is that obtained from guns and howitzers, the charges being generally fixed, and the ranges regulated by the elevation of the axis of the piece, rarely over 10°.

Vertical fire is that obtained from mortars, these pieces being usually fixed at a constant elevation of 45°, and the ranges regulated by increase or decrease of charge.

Howitzers and guns, under extraordinary circumstances, may be employed for *vertical* fire.

Name the various kinds of horizontal fire.

Various kin
of H. F.

Direct, oblique, cross, reverse, enfilade, ricochet, and curved (*for which, see under these headings*).

Upon what do the accuracy of fire and extent of ground effectively covered depend, in horizontal fire?

Accuracy of
Fire.

On the lowness of the trajectory, to obtain which, a high velocity must be given to the projectile by employing the largest charge which the piece is capable of firing.

Flaws.

How are flaws in the bore of a rifled gun detected?

Guns are to be periodically examined in the following manner. The inspector, before examining the gun, should be provided with the "memorandum of examination". (*Vide Examination.*) The bore must be thoroughly cleaned and examined by aid of a lamp, with prickers and spring searchers. If there are any new defects discovered, or if any old ones have materially increased, a gutta percha impression must be taken.

When
dangerous.

When are the flaws in the barrel of a gun dangerous?

When they are other than defects characteristic of the material of which the barrel is made; or, as a rule, those made by *scoring*, or the bursting of a shell in the bore. The dangerous nature of a flaw depends on its position; the nearer the end of the bore, the more dangerous it is. The depth of a defect in a coiled barrel is of more importance than its extent; but, should a defective weld run right round, the gun must be condemned. In solid forged barrels, a flaw running lengthways is apt to develop into a crack, but discrimination must be used between this and a mere streaky line, which is unimportant. A crack extending into the powder chamber of a steel barrel may be very fine, and only to be discovered by taking an impression. If it exists, the gun must be provisionally condemned.

Forces
acting
inside bore.
Fords.

See **Bore.**

In crossing a ford of any considerable width what precautions should be taken?

Rows of stakes should be driven in, showing its exact limit. Torches or lanterns should be used at night to mark the line of crossing. When the current is rapid, boats should be kept plying about near the dangerous places in case of accident.

**Forfeits of
pay.**

See **Stoppages.**

Under what circumstances does a soldier forfeit service? **Forfeits o**

Under the Army Service Act of 1847, a soldier forfeits, **service.** towards limited engagement, every day of absence by reason of—(a) Imprisonment by Civil Court or Court Martial. (b) Desertion. (c) Being a prisoner of war through wilful neglect. Under Acts of 1867 and 1870, in addition to the above—(d) Detention awaiting trial if convicted. (e) Absence without leave over 5 days.

Service towards pension and G.C. pay is forfeited for all the preceding, by men enlisted under Acts of 1847, 1867, and 1870.

A soldier forfeits the whole of his prior service towards G.C. pay and pension—(a) When found guilty by C.M. of desertion, wilfully tampering with his eyes, maiming or injuring himself or any other soldier, with intent to render unfit for service. (b) When sentenced to penal servitude, or convicted of felony. (c) When confessing desertion, the trial having been dispensed with.

For what purposes are solid forgings used? Describe **Forgings solid.** *their manufacture.*

For breech-pieces, trunnion rings, cascables, &c. A charge of scrap-iron is put into a reverberatory furnace, and, when sufficiently heated to stick together, brought out in balls weighing about 1 cwt., placed under a steam hammer and formed into an oblong block called a "bloom". This is again heated and hammered into a flat cake, several of which are "piled" together, heated, and formed into a slab. The slabs are successively welded together on the end of a *porter* bar, which acts both as lever and tongs in manipulating the work.

Describe the difference between the Fraser construction **Fraser construction.** *of wrought iron M. L. guns and the Armstrong.*

The gun is built up with a few double or triple coils instead of several finely-finished single ones, the result

FRASER—FUZES.

being a much cheaper and equally serviceable construction.

Muzzle-loading Rifled Guns.

Explain the nature of the friction between the projectile and the bore of a rifled gun ; also, its effect on the velocity of projectile, and strain upon gun.

The friction is of two kinds, that of *quiescence* and that of *motion*. Friction, in the first instance, prevents the ~~shot~~ moving, and, according to its amount, affects the time ~~for~~ combustion of charge, and, therefore, the tension of ~~the gas~~. The more powder converted into gas, the greater ~~the force~~ exerted on metal of gun, and on base of projectile ; and as the latter moves through the bore, friction will act upon it as a retarding force, and, to some extent, increase ~~the~~ strain.

What front is required for a Field Battery of 6 guns equipped for service, at full interval, and what length of road would be required for the same in column of route ?

The front required for a 9-pr. battery is 98 yards, and for a 16-pr., 118 yards.

The length of road for a 9-pr. battery would be about 300 yards, and for a 16-pr., about 340 yards.

This calculation is based on the detail laid down for a battery equipped for service, the 9-pr. having 6 horses in each gun and wagon, including the forge, store, and G.S. wagons, and 8 spare horses ; the 16-pr., with 8 horses in each gun and wagon, and 10 spare horses.

Into what two classes may all fuzes be divided ?

Into *time* and *percussion*.

What are the conditions to be fulfilled in time fuzes ?

1. That they should ignite with certainty.
2. That they should burn regularly.

3. That, when ignited, they should not be liable to extinction on striking earth, water, or wood.

What are the time fuzes for S. B. Ordnance?

For S. B. O

The Common fuze, Diaphragm fuze, Mortar fuze (large), Mortar fuze (small). They consist of a case of wood, into which is pressed fuze composition, by hydraulic pressure.

What is Fuze Composition, and what its qualities?

Composition

It consists of Saltpetre (ground) 3 lbs. 4 oz.

Sulphur (sublimed) 1 lb.

Powder (pit meal) 2 lbs. 12 oz.

It burns regularly and progressively at the rate of one inch in 5 seconds.

What is the principle of the large mortar fuze?

Large Mortar Fuze.

It consists of a cone of beech wood driven with 6 inches of composition, the composition bore being in centre of the wooden cone. There is one set of side holes bored spirally, they are 0.2 inches apart, the top one being 2" and the lowest 6" from the bottom of priming hole; the lowest is bored through into the composition. The head of the fuze is protected by a tin cap and disc of pasteboard, which is removed before the shell is placed in the mortar. Ignition is secured by means of a quick match priming, and also by the hole in the top of the fuze composition; the flash passes through the bored hole and explodes shell.

Describe the small mortar fuze.

Small Mortar Fuze.

It is similar to large mortar fuze, except that it is shorter and smaller in diameter, has only 3" of composition, and the top side hole is 1" below bottom of priming hole.

Describe common fuze.

Common Fuze.

The case is a truncated cone of beech wood, about 3" long, having composition bore eccentric with regard to ex-

Common Fuze (continued).

terior, and two powder channels bored parallel to composition on side with greatest thickness of wood, which are bored through to the bottom to conduct the flame to the shell. In head of fuze there is quick match and priming. Side holes, 0.2" apart, are made into the powder channels. There is one channel indicating even, and the other odd tenths of fuze composition. The bottom hole of each row is continued into the composition bore, to ensure the eventual bursting of the shell, should the boring have been badly executed. The powder channels are filled with rifle powder, and side holes have the same powder and clay pressed into them, the clay outside; the last side holes in each row, and the portions of powder channels below them are filled with quick match. A hole is bored through priming, and to a depth of 0.4 inches into the composition, to ensure ignition of fuze. Three pieces of quick match are placed in cup, the ends of two passing through four holes in the side, and the third is bent under one of the others. The priming of cup is powder damped with distilled water. This fuze has a metallic cap to preserve the priming, inside of which is a disc of cardboard, having a piece of tape attached to it. The cap is removed by pulling the tape when the shell is placed in the bore of the piece. The fuze has two inches of composition.

Diaphragm fuze.

Describe diaphragm fuze.

Similar to common fuze, except that it is shorter, and has only 1 inch of solid composition. The powder channels are connected by a groove filled with quickmatch, so that both are fired together, because the fuze is in a socket, and the flame has to make its way through the fire hole in it to the powder in the shell.

Chance, various S. B. fuzes are used with.

With what pieces of ordnance are these fuzes respectively used?

1. *Large Mortar* fuze is used with 8", 10", and 13" S. B. (continued). mortar shells.

2. *Small Mortar* fuze with common shell fired from 5½" royal, and 4¾" coehorn mortars at long ranges.

3. *Common* fuze with S.B. common shell, and instead of *small mortar* fuze at short ranges. It is also used with 100-pr. diaphragm Shrapnel shell.

4. *Diaphragm* fuze used for diaphragm Shrapnel shell.

What time fuzes are used with M.L.R. ordnance?

For M. L. Ordnance.

5 seconds M.L., 9 seconds M.L., and 20 seconds M.L.

Describe 5 seconds M.L. fuze.

5 Seconds
M. L. Fuz

It resembles the *common* fuze, but head is closed with a gun metal plug, round the pin of which quick match is looped and led through two fire holes to a groove. It is therefore a little longer than common fuze; it contains two inches of *mealed* powder, and burns 5 seconds. A paper lining is introduced to prevent the formation of a Paper Lin space between the wood and composition in the event of the wood shrinking, which would cause the fuze to act prematurely. No clay stopping in side holes; powder channels only covered with varnished paper, and united by quick match at bottom of fuze. Marking of fuze commences at 1, and side holes are numbered 1, 1·5, &c.; thus enabling the fuze to be bored to quarter seconds. Painted red and drab to distinguish it from 9" fuze.

Describe 9 seconds M.L. fuze?

9 Seconds
M. L. Fuz

Construction and size identical with 5 seconds, except that fuze composition is used, and it burns 10 seconds; consequently, side holes are numbered 2, 3, 4, 5, &c., up to 19. Above fuze composition the fuze is driven with 4" of mealed powder, to obviate risk of cracking the composition in boring. Painted black and drab.

9" M. L. R.
Fuze (*continued*).

Why is this fuze called the 9 seconds fuze when it burns 10 seconds?

Because this fuze is named from the time it burns when in flight in some of the heavier natures of rifled shell; all other fuzes take their name from the time they burn at rest.

20 Seconds
M. L. Fuze.

Describe 20 seconds M.L. fuze.

General construction and action resembles a mortar fuze as it has no powder channels, but the arrangements as to priming, paper lining, &c., are the same as with other M.L. fuzes. It has a pellet of mealed powder passing through the fuze at the bottom of the composition, which pellet is pierced and carries the flash from the bottom of the fuze. The marking begins at 20, and only reads to even half seconds.

Ordnance,
various M. L.
Fuzes are
used with.

With what pieces of ordnance are these fuzes respectively used?

1. *5 seconds M.L. fuze* is used for R.M.L. Shrapnel shell (G.S. gauge), up to 80-pr. inclusive; available with Shrapnel shell up to 1700 yards range.

2. *9 seconds M.L. fuze*—Used with S.B. naval shell; R.M.L. common shell, up to 80-pr. inclusive; and with R.M.L. Shrapnel shell (G.S. gauge), up to 80-pr. inclusive, after 1700 yards' range. In S.S. it may be used with the 7-inch R.M.L. common or double shell, when 14 lb. charges are employed. It is also the fuze issued for Shrapnel to the 7-inch R.M.L. guns and upwards in the navy.

3. *20 seconds M.L. fuze*—Used for S.B. naval and R.M.L. common shell (G.S. gauge, garrison service), up to the 80-pr. inclusive, at long ranges. It is only used in the F.S. for high angle firing from the 7-pr. gun. In the S.S., it may be used with the 7" R.M.L. common shell, when 14 lb. charges are employed.

How would you distinguish the 5" from 9" fuse when packed in tin cylinders? R. M. L. (continued)

The lid of tin cylinder, containing 5" fuzes, is painted red; that containing 9" painted black. The nature of the fuze is also shown on the lid.

What time fuzes are there in the service for B.L. ord- For B. L. (nance ?

The 5" B.L., 9" B.L., and 20" B.L. Boxer time fuzes, and the Armstrong E time fuze.

Describe 5" B.L. fuze.

5" B. L. Fu

It resembles the 5" M.L. fuze, with the exception that it is a little larger, and there is a detonating arrangement in the head, which is necessary on account of there being no windage in B.L. guns; this consists of a cylinder of alloy resembling gun metal, which is screwed into the head of the fuze. This cylinder contains a hammer, supported by a copper wire; below the hammer is a hollow in the cylinder containing detonating composition. A hole is bored through the cylinder for the passage of the flash. The hammer is also supported by a safety pin, which is withdrawn by tape just before placing shell in gun. There are three escape holes to allow of escape of gas; they are protected by thin copper discs and papier maché plugs. The exterior of head is woolded with wire to prevent splitting when the detonator is screwed in. The ignition is produced by inertia of hammer, causing it to shear the copper wire, and fall on the detonating composition, exploding it and igniting the fuze. Action.

Describe 9" B.L. fuze.

9" B. L. Fu

Construction identical with that of 9" M.L. fuze except head which is same as in 5" B.L. fuze. The boxes containing these fuzes are recognised in same manner as with M.L. fuzes.

20" B. L. Fuze. *Describe 20" B.L. fuze.*
 Identical with 20" M.L. fuze except head which is same as that in 5" B.L. fuze.

Rule for finding length of Fuze. *Give a short rule for finding length of fuze in rifled guns.*

Divide the number of hundreds of yards in the range by 2 and add 1 up to 1000 yards, 2 up to 2000 yards, and so on for length of fuze in tenths of inches.

Same rule for Mortars. *Give a short rule for finding length of fuze for mortars.*
 Add 17 to the number of hundreds of yards in the range for the length of fuze in tenths of inches.

Use of 5" and 9" Fuzes. *When would you use 5" and 9" B.L. fuzes ?*
 5" with Shrapnel up to 1600 yards ; 9" for higher ranges.

Can B.L. fuze be used for R.M.L. ordnance ?
 Yes, on an emergency.

3 Compositions in 9" Fuzes. *There are three different substances composed of the same ingredients as Gunpowder in the 9" M.L. and 9" B.L. fuzes, what are they and for what purpose ?*

Fuze Composition, Mealed Powder, and Common Powder (Pistol Powder). The Fuze Composition burns at the rate of 1 inch in 5 seconds, and is used because it burns regularly and therefore when bored into at any desired length the flame from it (when ignited) will fire the shell at the given time corresponding to that length. The Mealed Powder burns at the rate of 2 inches in 5 seconds and 0.4" of it is placed above the fuze composition to obviate the risk of cracking the composition in boring for a very short range. The Pistol Powder in the side channels is employed to convey the flash from the fuze into the shell at the required moment, the flash passing through the powder *instantaneously*.

For what is the Armstrong "E" time fuze used?

"E" Time
Fuze.

The Armstrong "E" time fuze is no longer used for L.S., it is only served out to the Navy for B.L. segment shells F.S. It may therefore be considered nearly obsolete. The latest pattern may be known by the word "cap" stamped on the base of the fuze.

With what ordnance are the various B.L. fuzes respectively used?

Ordnance,
B. L. Fuzes
used with.

The 5" B.L. fuze is used with B.L. Shrapnel shells (G.S. gauge) for F.S.

The 9" B.L. fuze used with B.L. common, segment, and Shrapnel shell (G.S. gauge) for garrison and Naval service, and with Shrapnel for F.S. at long ranges.

The 20" B.L. fuze is used with B.L. common and segment shell (G.S. gauge), garrison, or Naval service, at long ranges.

In case a shell appears to be blind, how would you bore the next fuze?

Blind Shell

A little shorter, as a long fuze is often put out on graze.

How are wood fuzes packed?

Packing.

In tin cylinders each containing five. The lid is closed with a metal strip soldered on with one end detached which is pulled to remove the strip before opening the box.

For what are percussion fuzes used?

Percussion
Fuzes.

They are used in shells intended exclusively to act against solid obstacles such as earth-works, masonry, or wooden ships; they are also used in shells employed against troops in the field. For the first purpose they should act only on direct impact, for the second purpose they should act on graze almost instantaneously. For the former the Pettman's G.S., and for the latter the R.L. screw, and B.L. plain percussion fuzes are adapted.

Percussion
fuzes (con-
inued).

Name the various percussion fuzes in the service, and the different shell they are used with.

1. Pettman's L.S. fuze, used with common shell of common gauge.

2. Pettman's G.S. fuze acts equally well from a S.B., B.L., or R.M.L. gun; used with common, double, and segment shells of the garrison calibres fired from rifled guns, and with naval shells fired from S.B. guns.

3. B.L. plain percussion fuze, used with B.L., common, and segment shell, F.S.

4. R.L. percussion fuze, Mark I., used with R.M.L. 7-pr. and 9-pr., common, and Shrapnel shell, F.S.

5. R.L. percussion fuze, Mark II., for use in L.S., with all B.L. shell having G.S. fuze hole, and all R.M.L. shell up to the 80-pr. inclusive, and in the S.S. with 7 and 9-pr. R.M.L. shells only, with the exception in both services of 7-pr. double shell, as the small charge (4 oz.) used with these shell will not set it in action.

Pettman's
L. S. Fuze.

Describe the Pettman's percussion fuze, L.S.

action.

The fuze consists of the *body* of gun metal, the *ball*, *cone plug*, and *steady plug*, of a harder alloy to strengthen them, the *lead cup*, the *bottom plug* of gun metal, and the remaining parts of gun metal. The ball is roughened with vertical grooves, and has a horizontal groove as well. It is coated with detonating composition. Varnished gut is tied over it, and a cover of varnished silk over that to keep off damp, and prevent premature explosion. A strand of quick match closes the hole in the bottom plug. On firing, the shock of discharge crushes up the lead cup, the ball, cone plug, and steady plug setting back. On the shell striking the object, the ball, now unsupported, is dashed violently against the side of the body, explodes the detonating composition, and fires the shell, the flash passing through holes in the cone and bottom plugs.

How do you know when a shell will take the Pettman's L.S. fuze?

By a cross cut on the plug.

Describe the Pettman's percussion fuze, G.S.

Pettman's
G.S. Fuze.

The principal parts are the *body, top plug, plain ball, steady plug, detonating ball, cone plug, and lead cup.* The Body.

body is conical, tapped throughout with a screw to screw into G.S. gauge fuze-hole, it is about 0.2" thick, slightly hollowed out in the centre to allow play to detonating ball, and also at base to allow lead cup to dovetail into it when crushed. There are two slots cut in top of body to allow fuze to be screwed into shell; it is tapped at top to receive top plug. There is a fire hole in centre of base.

The top plug is a small disc of gun metal, with two Top-plug. holes in upper part to enable it to be screwed into fuze, and a recess into which plain ball fits; it is tapped with a screw thread to fit body.

The plain ball is a small solid brass ball.

Plain ball.

The steady plug is a brass disc recessed at top, and Steady-plug roughed to receive a ring of detonating composition, having a cup in the centre to receive the plain ball; there are three fire holes in it for flash to pass down. A detonating composition is pressed into recess, covered by a thin copper washer.

The detonating ball is roughed by a number of vertical Detonating grooves, with deep horizontal groove; these grooves re-ball. tain the composition with which ball is coated, and render ignition certain. At top of ball is a cylindrical projection which fits into steady plug, and at bottom is a smaller projection fitting cone plug. Over composition, two thin copper hemispheres are placed and united by a piece of shellaced paper; the ball is further protected by cover of varnished gut and silk.

The cone plug is pierced with three fire holes, the Cone-plug. central one being slightly enlarged to support detonating

Pettman's
G.S. Fuze
(continued).

ball; the bottom of plug contains a chamber filled with mealed powder, driven like a tube; it is recessed near top of cylindrical part to allow lead cup to dovetail into it, pierced near base for suspending wire, and closed by small cardboard disc at base.

Lead cup.

The lead cup is a hollow cylinder having a flange on the head to fit the recess on the cone plug.

Action.

1. When fired from a M.L. gun, the steady plug, ball, and cone plug set back on shock of firing, suspending wire is broken, lead cup prevents rebound, and stem of cone plug protrudes through base of fuze. On striking, the action will be same as in L.S. fuze, the flash finding exit through holes in cone plug to the priming, and thence to powder in shell.

2. When fired from a B.L. gun, the steady plug may not disengage, and detonating ball will not act; the plain ball is released by steady plug setting back, and spins round the circumference of body, over the ring of detonating composition. On shock of striking object, the ring is dashed against the plain ball and detonates, exploding shell through fire holes.

B.L. plain
Percussion
Fuze.

Describe the B.L. plain percussion fuze.

This fuze consists of *body, guard, pellet, cap, bottom, and safety pin.*

Body.

The body is made of gun metal, and has a rim projecting at top, which ensures fuze being placed in proper position in shell. In the centre of the top, on the inside, is fixed a steel needle, point down; the top is pierced with 4 holes to allow of action of the "E" time fuze, which is still used in the navy, in conjunction with the B.L. plain fuze. A washer of thin sheet brass closes these holes.

Guard.

The guard consists of a gun metal collar pierced with two holes for the safety pin, and fits inside next the top; it is recessed inside to receive head of pellet.

The pellet is cast of equal parts of lead and tin ; it is Pellet. hollowed out and receives in its top the copper cap, which is primed with cap composition, pressed and varnished as in gun caps. The composition is further protected by a very thin disc of brass ; a disc of paper, coated with shellac, is stuck on top of pellet, covering cap. The cap is pierced Cap. with 3 small holes, arranged so as not to interfere with action of needle ; these holes allow the flash to pass down to the lower part of the pellet, which is filled with a pellet of mealed powder, pierced like a tube and roughened. On exterior of pellet are 4 flanges or feathers, and below it a disc of paper to prevent its adhering to bottom of fuze.

The bottom consists of a gun-metal disc which screws Bottom. into the base of the fuze ; in the centre is a small recess which contains mealed powder, driven and pierced as usual. This recess is closed by a thin brass disc on exterior.

The safety pin is of twisted brass wire, and has a piece Safety pin. of tape attached to it to enable it to be withdrawn readily.

To prepare the fuze, remove the safety pin and drop the Preparation fuze into the shell, rim to the front ; replace the plug in the shell, except for naval service, when " E " time fuze is used.

When the safety pin is removed, the collar is supported Action. by the flanges or feathers of the pellet. On shock of discharge these are sheared off by collar setting back, and on striking object or grazing, the pellet and collar fly forward, the cap comes in contact with the needle and explodes the fuze.

How many classes of R.L. percussion fuzes are there ?

Two, Mark I. and Mark II.

R.L. Per-
cussion Fuz

Describe R.L. percussion fuze, Mark I.

It exactly resembles the B.L. percussion fuze in its internal arrangements. Body is of gun metal ; both body

R.L. Per-
cussion Fuz
Mark I.

R.L. Fuze,
Mark I. (*continued*).

and top are cast in one piece ; the bottom is screwed in ; a square hole in the head fits the G.S. key, by which it is screwed into the shell. This fuze fits G.S. gauge. As hole for safety pin is exposed to flash of discharge, a lead pellet is inserted above safety pin. On ramming home, this pellet flies forward and closes the safety-pin hole. The safety pin is a plain brass wire, with brass wire ring which fits round neck of fuze ; it has a tape attached to it, and it is kept in its place by pasting a slip of paper over tape.

N.B. The pin is never to be withdrawn until shell is placed in gun.

R.L. Percussion Fuze,
Mark II.

Describe R.L. percussion fuze, Mark II.

It is almost identical with Mark I. ; the few points of difference being that the walls are much stronger, entailing a reduction in the size of the interior parts of the fuze. The bottom is made with a deeper screw thread, enabling it to support the weight of the pellet and guard on the shock of discharge. The safety pin is made of twisted wire, as in B.L. plain fuze. The pellet is supported by two projecting feathers, and has a cup in its head containing a large quantity of detonating composition. There is no powder in the pellet. The action and preparation is similar to B.L. and R.L., Mark I. It was introduced because Mark I. was found to fail with heavy charges.

Special Fuzes. *What special fuzes are there in the service ?*

Hand Grenade Fuze.

(1) The *hand grenade* fuze, used with 3-pr. or 6-pr. hand grenades—small diameter, 1·5 inches of composition, which burns 7·5 seconds ; no boring required ; fuze lighted by a portfire. Fuze is made of wood.

Parachute Fuzes.

(2) *Parachute fuzes*—figures give time of burning in seconds. Fuzes are painted blue. The 10" Parachute fuze has 3 inches of composition, and burns 15 seconds.

The 8" Parachute fuze has 2 inches of slow burning composition, which burns 13 seconds. The 5½" Parachute fuze has 1·5 inches of slow burning composition, which burns 10 seconds. These fuzes are made of wood.

(3) Fuze of *Life-saving Rocket* is 1·5 inches long, and Rocket Fuze made of paper; it contains an inch of ordinary fuze composition. It is conical in shape, and the sides are covered with kamptulicon, being brought up to fit the vent in the base of the life-saving rocket. It has a paper cap tied on with twine, which need not be removed before firing. It burns about 5 seconds, and is for use with the portfire.

Why is it necessary in all time fuzes to drill a small hole in the top of the fuze composition? Hole in top
Compositio

It roughens the surface, and renders ignition certain. If it were not done, the hard polished surface of the fuze composition would often fail to be ignited by the priming. The hole is also of use to fix the zero point, from which the burning of the fuze is reckoned, the length of the composition being measured from the bottom of the hole.

With what guns is gun cotton priming to be used, and when? Gun Cotton
Priming.

With R.M.L. field guns, when firing at high angles with small charges, as then the quick match often fails to ignite.

How is the gun cotton issued, and how attached to the fuze?

It is issued in tin cylinders containing 20 feet of loosely twisted gun cotton and strands of silk for attaching it to the fuze; the cylinder holds enough for 20 fuzes. To attach it to fuze, uncap the fuze as usual, open out the priming, and wind about 10 or 12 inches of the gun cotton round it, bringing the ends of the priming between the strands of gun cotton; tie the two ends of the latter to-

~~rubber~~, leaving about two inches loose, then fix the whole ~~securely~~ by tying over it a piece of silk. The shell must be ~~placed~~ in the gun directly the gun cotton is attached, as ~~otherwise~~ the slightest spark would certainly ignite the ~~fuse~~.

G.

See **M.L.R.** and **Palliser.**

What natures of Gatling guns are there used in the service ?

**Gas channel.
Gatling guns.**

The 0.45 inch and 0.65 inch.

Give the weights, system of rifling, and weights of bullets of each.

Of the 0.45 inch—weight 3 cwt. 108 lbs.—system of rifling, Martini-Henry—10 barrels—weight of bullet 480 grains.

Of the 0.65 inch—weight 7 cwt. 35 lbs.—system of rifling, Martini-Henry—10 barrels.

For what are they specially adapted ?

Use.

For the defence of flanks, bridges, streets, breaches, or open ground, one great advantage being that they do not recoil; and, therefore, when the range is once obtained, little alteration is required in laying.

Give a brief description of the Gatling gun and mode of working it.

Description

The various principal parts are the *barrels, locks, lock cylinder, carrier, feeding drum, hopper, crank, and traversing worm.* The detachment consists of one N.C.O. and 4 gunners. The duties are as follows:—

No. 1 stands on right side of centre of trail, commands, places traversing lever, prepares crank for firing, points and fires.

No. 2 stands 10 yards in rear of 3 whom he supplies with drums.

Duties of
Detachment
(continued).

No. 3 stands between the breech and wheel on the left side, places drums on the hopper, and attends to them.

No. 4 stands on off side of splinter bar of the limber, supplies 2 with drums from 5.

No. 5 stands on near side of splinter bar of the limber, and supplies 4 with drums.

Traversing
Worm.

What is the object of the traversing worm?

To give a certain amount of spread to the bullets while firing.

Drum.

What number of cartridges does the drum contain when filled?

The drum is divided into 16 compartments, each holding 15 cartridges.

Gauges.

Give a list of the service fuze-hole gauges for all shell, and the fuzes they take.

GAUGE.	SHELL.	FUZE.
Large Mortar.	Large Mortar 13", 10", 8".	Large Mortar, time
Common.	S. B. common and diaphragm.	Common, diaphragm, and small mortar, time; Pettman's L.S. percussion.
General service	S. B. Naval shells and all rifled shells, except B. L. field service, segment and common.	5, 9, or 20 secs. B. L. or M. L. time. Royal Laboratory screw percussion and Pettman's G. S. percussion fuzes.
Armstrong field service.	B. L. field service, segment and common.	B. L. plain percussion and for S. S. Armstrong "E" time fuze.

What are the regulations with respect to Good Conduct pay? **Good conduct pay.**

A soldier is entitled to G.C. pay according to the following rates:—

After 2 years' service without a Regtl. entry, 1d. per diem.

" 6	"	"	"	2d.	"
" 12	"	"	"	3d.	"
" 18	"	"	"	4d.	"
" 23	"	"	"	5d.	"
" 28	"	"	"	6d.	"

After 16 years', if 14 years without entry, he is entitled to 4d. per diem, and at 21 years', to 5d., and at 26 years', to 6d.

After 21 years', if 14 years clear, to 5d. and at 26 years', to 6d.

After 26 years', if 14 years clear, to 6d.

One entry, when not in receipt of G.C. pay, defers its receipt 2 years from date of offence.

When in possession of 1d., it is forfeited for 1 year, and a second entry within 12 months defers its restoration 2 years from date of offence.

When in possession of 2d., one entry forfeits 1d. for 1 year; a second entry within 12 months defers the regaining of 1st badge 1 year, and 2nd badge 1 year after that; a third entry prolongs the period for regaining 1st badge another year, the 2nd badge a year beyond that, and the 3rd badge a year beyond that. After loss of all badges, two years are necessary for restoration of each.

What is the construction of Coffin's grape shot; with what guns and for what purpose is it used? **Grape shot.**

It consists of a number of cast-iron balls arranged in three tiers by means of three cast-iron circular plates, and a bottom plate of wrought-iron; the plates are pierced with holes to grip the shot, and are held together by a

Grape Shot
(continued).

wrought-iron bolt passing through them. The number of shot in each tier varies from 3 to 5.

Supplied to all S.B. guns except the 10", 100, 150, and 3-prs. and carronades; for the three former natures a kind of case is used, made of iron with iron-handles, and for the two latter a tin cylinder, painted red, and filled with heavier balls than the common case.

Use.

Used for the same purpose as case—Range, up to 600 yards.

Gratuities
with Medal.

To whom are medals with gratuities given?

To all soldiers, on recommendation of C.-in-chief, after 18 years' service with an irreproachable character—*i.e.*, their names must not have been entered 12 times in the Regimental Defaulter Book, nor must they have been convicted by C.M., except in the case of a N.C.O. convicted of an offence for which he would not have been necessarily tried had he been a private soldier. Except under special circumstances no man without 4 G.C. badges should be recommended. The amount of the gratuity is not to exceed £5. N.B.—A N.C.O. convicted by C.M. of any offence, except those mentioned in 81st and 168th Art. of War, becomes eligible after 5 years' continuous good conduct.

From Fines.

State regulations with reference to gratuities from fund formed from fines for drunkenness.

Every soldier discharged, except for misconduct, will receive 20s. for each G.C. badge, total not to exceed £3, except in case of soldier not recorded for drunkenness for 10 years previous. In this case the limit is £4 with 4 G.C. badges and £5 with 5 G.C. badges.

Grenades,
hand.

Describe the hand grenade and state what means are employed to fire a number of them from a mortar.

Hand grenades are of two sizes, 6-pr. and 3-pr. They

resemble common shells, but the walls of the shell are not so thick, being about $\frac{1}{4}$ of the diameter. Fuze hole much smaller, and smooth.

Generally issued empty and loose for L.S., and filled and fuze for S.S., the fuze being covered with kit plaster.

Used chiefly for defence of places against assault by throwing them amongst the storming-party in the ditch. Can be thrown by hand 20 or 30 yards.

When fired from mortars they are placed on wooden bottoms.

See **Rifling.**

Grooves.

Detail the duties of commanders of guards.

Guards.

They are to make themselves thoroughly acquainted with all the orders for their guards, as well as with those on each sentry's post. Standing orders to be read and explained as soon as guard has mounted. Every relief to be inspected before going to, and also on returning from, its post. To go their rounds at least twice by day and twice by night. To exercise the greatest vigilance that all duties are correctly and exactly performed, and that no irregularities occur.

Commanders are never to quit their guards except to visit the sentries; neither are they permitted to take off their clothing or accoutrements.

What does the guard do when a fire breaks out or any alarm is raised?

It turns out and remains under arms, so continuing until the fire is extinguished or the cause of alarm has subsided.

See **Advanced and Rear.**

Guards advanced, &c.

What is gun cotton?

Gun Cotton.

Cotton thoroughly cleansed from all fatty or foreign matter, steeped in a solution of Nitric and Sulphuric

Acid ; it is then finally washed to get rid of any free acid which would be fatal to its keeping qualities.

Exploding Point.

What is the exploding point of gun cotton and how is this quality taken advantage of ?

Exploding point 343° F. For this reason it is used as priming for fuzes when very small charges are employed.

Discs.

In what form is gun cotton most largely used ?

In the form of solid discs or slabs produced by pulping. The discs are 3 inches in diameter and 2 in thickness.

Effects of Ignition.

State the effects produced by igniting gun cotton—(1) when unconfined, and (2) when confined.

(1.) It burns quietly and rapidly with a bright yellow flame.

(2.) It explodes with great violence, the strength of the explosion depending on the thickness and material of the case.

Detonation.

How may gun cotton be detonated ?

By a blow or by the action of various detonating bodies of which *Fulminate of Mercury* is the most effective.

Use.

What is gun cotton chiefly used for ?

For torpedoes and the destruction of stockades, bridges, &c. In the latter case flat oblong slabs are used, perforated with four holes. They are fastened or laid against the stockade, touching each other, and exploded by a detonator.

Advantages.

What are the advantages claimed for gun cotton over gunpowder ?

(1.) Less weight produces equal effect.

(2.) The method of preparation is simpler, safer, and less expensive.

(3.) It leaves a very slight residue and evolves no smoke.

- (4.) It can be kept under water without deteriorating. Gun Cotton
 (5.) It is not prone to spontaneous combustion. (continued).

What is the method of storing gun cotton ?

Storing.

It is stored damp in tanks with screwed on lids which are opened every three months, the cotton inspected and water run through the tanks.

For what purpose would gun cotton seem peculiarly adapted ?

For the bursting charge of shells.

What ingredients are used in the manufacture of Gun-Powder ?

Saltpetre, Charcoal, and Sulphur.

Ingredients.

What are the proportions of each in English gun-powder ?

75 parts of Saltpetre, 15 of Charcoal, and 10 of Sulphur.

How is the saltpetre prepared ?

Saltpetre.

It is imported from India in the form of "Grough Saltpetre" which is purified by boiling at a high temperature, then filtered, crystallized, and washed.

See **Laboratory**.

How is the charcoal made ?

Charcoal.

By charring wood in iron retorts called "Cylinders," and grinding it in a machine resembling a coffee mill.

See **Charcoal**.

From what woods is charcoal manufactured ?

From Willow, Alder, and Rhamnus Frangula (commonly designated black Dogwood). The two former are used for L.G., F.G., and R.L.G. ; and the latter for R.F.G. and Pistol Powder.

What is pit-charcoal, and for what is it used ?

Pit Charcoal

Pit-charcoal
(continued).

Charcoal made by charring wood under a layer of straw and sand. It is used for Pyrotechnic Compositions, Fuzes, &c., on account of its greater rapidity and regularity of burning.

Sulphur.

How is the sulphur prepared?

It is imported from Sicily, roughly purified by distillation, and is finally purified by a second distillation in iron retorts.

What are "flowers of sulphur"?

In the process of distillation, the vapour passes into a subliming chamber, and is there condensed into very fine particles, called "flowers of sulphur," which are used for Laboratory purposes.

Manufacture
of Gunpowder.

What processes has gunpowder to go through before the manufacture is completed?

After the ingredients are thoroughly mixed, the "green charge" is Incorporated, Broken-down, Pressed, Granulated, Dusted, Glazed, 2nd Dusted, Stoved, and, in the case of R.F.G., and similar fine grain powders, Dusted a 3rd time.

Give a short resumé of each of these operations.

Mixing is performed in a hollow revolving gun metal drum, with a shaft, provided with 44 arms passing through it, which revolves in a direction opposite to that of the drum. *Incorporating* is effected in a mill, consisting of a pair of heavy edge runners, which revolve on a circular bed of stone for stone runners, and iron for iron runners. *Breaking-down*, which is merely a preparation for pressing, is carried out in a machine consisting of two pairs of grooved rollers of gun metal, the one pair directly above the other. *Pressing* is necessary to impart an uniform density to the powder; it is effected in a hydraulic press; the meal from the breaking-down machine is shovelled

into a box containing a number of equi-distant plates, and then subjected to the requisite pressure. The *granulating* machine consists of 4 pairs of toothed rollers, and an arrangement of vibrating sieves below them, which are meshed according to the size of grain required. In the granulating of R.F.G., the two lower pairs of rollers are replaced by smooth ones. *Dusting* is effected in revolving reels covered with cloth, or wire mesh and *glazing* in revolving wooden barrels. These two processes being necessary to free the grains from dust, and to give them a surface, so as to prevent them from absorbing moisture, and to enable them to bear friction together without deteriorating. The operation of *stoving* is carried out in large chambers, heated with steam pipes. The third *dusting* which R.F.G. and other fine grain powders undergo after *stoving* is called *finishing*, and is done in a horizontal reel.

What substance is used in glazing R.L.G. powder, and for what purpose? Glazing.

Black lead, to lessen the quickness of ignition in the charges of rifled ordnance.

Into what two broad classes may the gunpowders now in use be divided? Classes.

Into *grain powders*, made by granulating the press cake and powders such as *pellet* or *prismatic*, made by compressing powder meal from the *breaking-down* machine into moulds.

See *post.* p.p. 114 and 115.

What is the general arrangement of the machine employed to make Pellet or Prismatic powder? Pellet and Prismatic.

A circular revolving table carries 4 mould plates containing 200 moulds each; at the bottom of the moulds, accurately fitting punches or pistons hang loose, and punches of larger diameter than the moulds are attached to the cross heads of two hydraulic rams above; the lower

Pellet and
Prismatic
(continued).

punches are pressed upwards, and the upper ones brought down by the rams, till a sufficient degree of density has been imparted to the pellet.

Examination
and Proof.

Enumerate the points to be determined in the examination and proof of gunpowder.

(1.) If the powder be of a proper colour, glaze, hardness, and crispness, free from dust and other foreign matters.

(2.) If it be properly incorporated.

(3.) If the grains be of proper size, shape, and in the proper proportions.

(4.) If it be of proper density.

(5.) If the action of the powder when fired be uniform, and up to a fixed standard.

(6.) If it contain the proper proportion of the three ingredients.

(7.) If it can withstand sufficiently the absorption of moisture.

Explain briefly the examination and proof of gunpowder.

Colour.

The colour is affected in two ways, that made from under-burnt charcoal is of a reddish tint; and of two powders of equal density, that taken off the mill-bed with an excess of moisture is blacker in colour than the other. The glaze, hardness, and crispness can only be tested by comparison and experience.

Glaze, Hard-
ness, and
Crispness.
Freedom from
Dust.

The freedom from dust and other foreign matter is ascertained by pouring rapidly a quantity of the powder from a bowl, held two or three feet above the barrel in a strong light.

Flashing.

A badly incorporated powder when "flashed" on a glass, porcelain, or copper plate will leave a residue of undecomposed saltpetre and sulphur, whilst a thoroughly incorporated charge will merely leave some smoke marks.

About 8 drams of power placed in an inverted copper Proof (continued). cylinder is generally " flashed " for this test.

The shape of the grains can only be judged by the eye ; Shape. the size and proportion with the sieve.

The most important quality of gunpowder is the *density*, Density. which is very accurately determined by an instrument called the *densimeter*, consisting of a barometer tube, a glass globe, and an air pump. The air is exhausted from the tube and globe, and mercury allowed to fill them. The globe is then taken off, weighed, and emptied. It is again put on with 100 grammes of powder, the air exhausted, and the mercury allowed to enter, when it is again taken off and weighed. The density is then ascertained by the formula, $\text{Density} = \frac{D \times 100}{(P^1 - P) + 100}$ where D = specific gravity of mercury, P = weight of globe full of powder and mercury, P¹ = weight of globe full of mercury alone, 100 = weight of powder employed.

The *firing proof* consists in measuring the velocity of Firing. a projectile fired from a 12-pr. or 9-pr. gun with a fixed charge, by means of the Chronoscope.

The small-arm powder is tested by firing from a Martini-Henry rifle.

In the *analytic* proof, the quantity of moisture in 100 Analysing. parts is first ascertained, and the dry powder then analysed by dissolving out the saltpetre with warm water, and the sulphur with bi-sulphide of carbon.

The *hygroscopic* test consists in subjecting dry samples Hygroscopic of powder to a damp atmosphere in a closed box, kept at Test. an uniform temperature, and weighing them at stated intervals, to ascertain the quantity of moisture absorbed.

How is loose gunpowder stored ?

Storing.

In barrels made of oak, bound with 4 copper and 6 ash hoops. They are of three sizes, viz., whole, half, and

quarter, and contain respectively 100 lbs., 50 lbs., and 25 lbs.
The whole barrel holds 125 lbs. P. powder, on account of its greater density. Barrels containing new powder are marked in seven lines; 1st line, "Powder"; 2nd, quantity; 3rd, maker's name; 4th, description of powder in red; 5th, date of stoving, number of barrels in stoving, and No. of barrel; 6th, No. of lot; 7th, Tare, or weight of barrel.

What is a budge barrel?

A quarter powder barrel with only one head, the other being replaced by a leather bag closed by a leather thong. It is used for holding loose powder for mortars.

How is loose powder conveyed by rail?

It is put in a flannel bag and placed in a half or quarter barrel which is covered with canvas and enclosed in an iron cylinder.

How is the size of grain of powder of any particular class determined?

By the size of the meshes of two sieves through one of which the grain, must pass, and be retained by the other: thus R.L.G. must pass a sieve of 4 meshes to the inch, and be retained on one of 8.

Name the powders actually in the service and their use.

(1.) L.G. (large grain), the old cannon powder, no longer made, but of which a large store still exists—size 8 to 16 inch mesh.

(2.) F.G. (fine grain), the old small-arm powder, no longer manufactured—size 16 to 36 mesh. For 7-pr. M.L.R., for all S.B. small-arms, and for bursting charges of Shrapnel shell.

(3.) R.L.G. (rifle large grain)—size 4 to 8 mesh. For 9, 8, and 7-inch M.L.R. guns S.S., battering charges of

all guns when P. is not available, and for practice with 9 and 16-prs. R.A.

(4.) R.F.G. (rifle fine grain), made with Dogwood charcoal—size 16 to 20 and more recently 12 to 20. For R.S.A. of every description except Martini-Henry, for 7-pr. M.L.R., and for bursting charges of Shrapnel when F.G. is exhausted.

(5.) R.F.G.², made with Dogwood charcoal—12 to 20 mesh. For Martini-Henry rifle.

(6.) *Pistol*, used for bursting charges of diaphragm and Shrapnel shells and for pistols—size 44 to 72.

(7.) *Pellet*.

(8.) *Pebble*, used for battering charges of all rifled guns of and over 7" calibre, and for all service charges of 40 lbs. and upwards—grain, cubical; length of side $\frac{3}{8}$ " to $\frac{5}{8}$ ". When no P. is available R.L.G. will be used.

What do you understand by "service" and what by "serviceable" powder?

Service and
Serviceable
Powder.

Service includes all powder used for firing projectiles from ordnance or small-arms.

Serviceable includes *service* powder, powder for blank charges, and powder for firing shells.

Detail the classification of powder according to its use. Classificatic

Class I.—*Service* powder, including all new powder and all powder found on examination to be uninjured; also R.L.G. and R.F.G. re-dusted and found good enough for this class.

Class II.—*Blank*, for exercise, salutes, &c.

Class III.—*Shell* powder, too dusty for class II.

Class IV.—*Doubtful* powder, set apart for examination.

Class V.—Powder condemned to be sold.

Class VI.—Powder only fit to have the saltpetre extracted.

Advantages. *What are the peculiar advantages of Gunpowder over any other propelling agent?*

- (1.) The ingredients may be obtained at small expense.
- (2.) The manufacture is attended with comparatively little chance of accident.
- (3.) None of the materials are deliquescent nor hygroscopic.
- (4.) It is quite safe to use, with ordinary precaution.
- (5.) The strain on the gun is not of an unbearable nature.
- (6.) The velocity it imparts is considerable without damaging the projectile or the gun.

Density. *What is the meaning of the term "Density" and how is gunpowder affected by this quality?*

The quantity of matter actually present in a certain bulk. The rate of the combustion of each grain is obviously affected by its density; and, on the rate of combustion of the charge, the velocity of the projectile in a great measure depends. In practice it has been found that a slight *increase of density* considerably diminishes the velocity. Increased density, however, improves the keeping qualities of powder and overcomes the fouling of the bore in small-arms.

Advantages of Pellet and Prismatic. *What are the advantages of Pellet and Prismatic powder?*

Greater regularity and effect, less strain, and less tendency to absorb moisture.

Advantages of P.-Powder. *What are the advantages of Pebble-powder over R.L.G.?*

From its high density and very large grain it burns slower and consequently strains the gun less. Hence its *employment for battering charges.*

What is the exploding point of gunpowder and at what point does it begin to deteriorate ? Exploding Point of Powder.

The exploding point is 600° F. and it begins to lose Sulphur at 212° F.

See **S.B., M.L.B., B.L., &c.**

Guns.

How many natures of triangle gynes are there in the service ? Give a short description. Gyns. Triangle.

Four, viz.—(1) 18' light, wood, to raise 7 tons.

(2) 18' heavy, wood, to raise 12 tons.

(3) 18' light, wrought-iron, to raise 7 tons.

(4) 18' heavy " " 12 tons.

A gyn consists of two cheeks with cross bars, a pry-pole, windlass, and a shackle with bolt and key.

The shackle-bolt connects the upper ends of the cheeks and pry-pole. The lower ends are connected by two iron cross bars, the windlass being first placed in position. The windlass is on the same plan as that of the sling-wagon.

In raising a weight where should the gyn be placed ? Position.
How are ; (1) two gynes ; (2) three gynes placed to lift a weight ?

In raising a weight the gyn should be placed as upright as possible, directly over the place where the weight when lowered is to rest.

(1) If of the same nature, they should be placed so as to bear an equal weight ; if of different natures, a proper proportionate weight ; *e.g.*, in lifting an 18-ton gun with a heavy and light 18' gyn, the latter should be placed twice as far from the C. of G. as the heavy one.

(2) The first, over the mark on chase of gun, the second, over the C. of G., the third, over the cascable.

Describe the Gibraltar Gyn and mode of using it. Gibraltar

The Gibraltar Gyn consists of two upright beams and a

horizontal one at top. From the centre of this latter beam hang two treble blocks to one of which is hooked a horizontal bar of iron turned up at each end. The gyn can be moved about by means of feet into which are let iron trucks, and the tackle is worked by a windlass, attached to one of the upright beams, which is moved by tooth and pinion work. The gyn weighs $10\frac{3}{4}$ cwt. and can support 3 tons with safety. To work it, it is wheeled over the gun across the direction of the axis of the gun so that the centre sheave in the cross-beam is directly over the C. of G., the direction of the cross-beam being at right angles to that of the axis of gun. The gun is lashed to the bar by two ropes, one on each of the trunnions, and the tackle worked by turning the handle of the windlass.

H.

Describe the fitting of the principal parts of the harness **Harness.**
used in the Royal Artillery.

(1) The *Saddle* is placed in middle of horse's back, front of it a hand's breadth behind the play of shoulder. It must not touch horse's backbone, the pannel being stuffed so as to have an equal pressure on horse's back, leaving room for two fingers to be introduced both in front and rear.

(2) The *Numnah* to be fastened on saddle or pad with straps tightly buckled round the flaps of pannels; care to be taken that the numnah does not rest on horse's withers.

(3) *Crupper* should admit the breadth of the hand between it and the horse's back, care being taken that none of the hair remains between it and dock.

(4) *Girth*, when buckled, to admit of a finger between it and horse.

(5) *Surcingle* to lie flat over, and not tighter than the girth.

(6) *Head Collar* to be so fitted that there should be room for two fingers between horse's nose and nose band, which should be the same distance below the cheek-bone.

Throat Lash to admit breadth of three fingers between it and horse's jaw

(7) *Collar* should admit the flat of the hand passing freely between it and the lower part of horse's neck, and just room for the fingers to pass between it and the sides of horse's neck.

(8) *Belly-band* buckled so as to hang the breadth of a hand below the horse's belly when in draught.

Fitting
Harness (*continued*).

(9) *Breeching* to be ten to twelve inches below the upper part of the dock ; and when the horses are hooked in, should have four inches play from the collar to the breeching.

(10) *Back-band* should be of such a length that the points of the shafts are above the line of draught.

(11) *Traces*. See **Traces**.

(12) *Bearing and Hip-straps* should be fitted so as to keep the traces in the same line.

Position in
Camp.

How is harness disposed of when in camp ?

Harness and saddlery to be laid down one yard in rear of line of heel pegs, the two sets being arranged in a heap, in the manner laid down.

Lead and
Wheel.

In what particulars do the Near Lead and Wheel harness differ, and in what does each differ from the harness of the Off horse ?

The Near Wheel has a *breeching* consisting of a *body piece*, and a *shaft-strap* (on the off side) ; it is fitted with a *hip-strap* and a *loin-strap* ; in the Near Lead there is no *breeching* nor *loin-strap*, and the *hip-strap* is fitted to the trace. The Off Wheel has two *shaft-straps*, a *tug* and *back-band*, and a *belly-bund* of tug. The Off Wheel and Lead have *pads* instead of saddles, and instead of *driving reins* they have *leading reins*, *bearing reins*, and *side reins*.

**Heads of
projectiles.**

What considerations govern the form of head to be given to a projectile ; which is the best form, and why ?

Flight and penetration ; the ogival. The flat-headed projectiles lose their velocity very quickly, and require a much greater velocity of rotation to overcome the resistance of the air. Again, the flat-headed shot on striking an armour plate punches out a piece and drives it into the backing, which increases the resistance, and therefore *decreases* the power of penetration. The ogival, on the other

hand, tears through the plate and bends it back, forcing it into the backing round the edge of the hole.

The flat-headed form has another disadvantage, viz., that it has a tendency to *set-up* or bulge, whilst the pointed form almost always retains its point intact after passing through the plates.

What were hollow shot employed for—what were their advantages and disadvantages, and why has their manufacture been discontinued? **Hollow shot.**

Chiefly for naval service. Advantages—Large diameter compared with weight; could be fired from lighter guns, and required less charges of powder. They were also considered to be more conducive to the formation of destructive splinters than solid shot, on account of their lower momentum. Disadvantages—Ranges and accuracy at considerable ranges were inferior to those of solid shot, as their decreased weight made them more subject to the resistance of the air. They are now replaced by common shell.

See **Fire.**

Horizontal fire.

See **Stoppages.**

Hospital.

See **Smooth-bore and M.L.R.**

Howitzers

How is the 8" M.L.R. Howitzer common shell distinguished from the 8" gun shell? **8" M.L.R. Common Shell.**

By the circumstance of the studs being all of one size.

I.

Iron,
Cast.

What is cast-iron ; what its merits and demerits as a material for ordnance ?

Cast-iron is the first result of extracting iron from the ore and contains many impurities, the principal of which are carbon and silicon. It is distinguished in the trade by numbers from 1 to 8, the lower numbers representing that with a fracture of "grey" or "mottled" appearance, and the higher, "white" or "bright," in which the carbon is almost entirely in a combined state. "Grey" cast-iron is more fusible and softer than white-iron, but less brittle ; and mottled-iron combines the properties of both, hence it is preferred for the manufacture of ordnance.

The presence of silicon, sulphur, and phosphorus, tends to render it brittle, and the unequal contraction and drawing away of the metal from the interior, in cooling, cause unsoundness in the mass, as well as an undue tension of the parts. For these reasons it is unfit to bear the strains to which rifled guns are subjected.

for Guns.

In fine, cast-iron is valuable on account of its *hardness*, but unsafe from its *brittleness*, and its tensile strength being low, when a gun constructed from this material fails, it bursts suddenly and violently. The only guns, therefore, for which it is used in this country are converted S.B. and in them the wrought-iron lining is depended upon to give safety to the structure.

Wrought-
iron.

What is wrought-iron ; what its merits and demerits ?

Wrought-iron is obtained from cast-iron by burning out the impurities in the process of "puddling". By rolling or drawing out under a hammer, it is given a fibrous

structure, the fibre running along the bar just as the fibre of wood runs along the stem and branches of a tree. It is valuable as a gun-material on account of its comparatively high *tenacity*, combined with its *malleability* and *ductility*. Wrought-iron
(continued),

Should the elastic limit be exceeded and the iron become permanently extended, the two latter properties come into play and give a large margin of extension before the limit of tenacity is reached and the metal breaks. For this reason it is preferred to steel for the exterior portions of guns. On the other hand it is inferior to steel as a material for inner barrels, because, being softer, it gets worn away and distended by very large charges, and moreover it is impossible to obtain it entirely free from slight flaws and defective welds which get rapidly increased and extended by the action of the gas, thus rendering the gun unserviceable. For this for Outer
Coils.

Cast-steel is perfectly clean and free from any defects; it presents a hard surface to the action of the powder and projectile, and its limit of elasticity being far higher, it is not so easily extended. If subjected to too sudden a strain it may split, but in this case the wrought-iron exterior absorbs the blow, and explosive rupture is avoided. See "Steel." Cast-steel for
inner barrel

Give different effects on wrought-iron and steel projectiles on striking iron plates. Projectiles of
Wrought-iron
and Steel,

The wrought-iron projectile on account of the softness and ductility of the metal gets flattened out, or as it is technically termed, *set up*; the steel projectile passes through uninjured or has merely the point flattened.

Why is cast-iron used for projectiles, why steel and chilled-iron? and of Cast-
iron and
Chilled-iron

Cast-iron; on account of its hardness, cheapness, and

Projectiles
(*continued*).

facility of working ; steel, on account of its hardness and high tensile strength ; chilled-iron, from its intense hardness and crushing strength, it has also the advantage of being much cheaper than steel.

J.

What are the descriptions of lifting jacks used in the **Jacks,**
service ? **Lifting.**

(1) Common or field jack consisting of a pedestal of Common. ash with a forked end of iron ; a lever is supported by a pin in the fork, the height of which can be suited to the height of the axletree. A *pawl* is attached to the lever which drops into the teeth of a rack and keeps it in position when the weight is upon it.

Used with 20-pra. and under—weight 17 lbs. Lifts half-a-ton.

(2) Common screw jack, similar to the ratchet-headed Screw. elevating screw used with the 40-pr. B.L.R.

Used with 40-pra. and siege guns—weight 64 lbs. Lifts Use. 5 tons.

(3) Rack and pinion jack, consisting of a vertical rack Rack and working in a block of elm, and taking the weight either Pinion. on the top or on a claw at the lower end. The bar is raised or lowered by toothed gear inside the block, which is turned by a winch handle on the outside. Lifts 3 tons.

(4) Haley's jack, consisting of a vertical screw, in a Haley's block of elm ; the screw passes through a metal nut with ratchet-collar, in which a worm wheel, turned by a winch outside, gears. Lifts 2 to 20 tons.

(5) Hydraulic jack, lifting from 2 to 20 tons. Hydraulic.

How is the Deputy-Judge-Advocate for a Court Martial **Judge-**
appointed ? **Advocate.**

By warrant addressed to himself.

What Courts Martial does he attend ?

Only General Courts Martial.

State his powers and duties.

(a) At a G.C.M. he represents the Judge-Advocate-General.

(b) Whether consulted or not he will give his advice on any matter before the Court ; he is responsible for the due formality and legality of the proceedings.

(c) At the conclusion of case, he sums up and gives his opinion on bearing of case, before the Court commences to deliberate on finding.

(d) His opinion must be considered conclusive upon any point of law or procedure arising at the trial.

(e) He is responsible to Judge-Advocate-General for a proper record of proceedings.

(f) When a prisoner is undefended, he must see that the prisoner loses no privilege allowed by law in the conduct of trial.

(g) His position must be entirely impartial.

(h) He cannot be challenged.

(i) He must furnish the prisoner with a copy of the charge against him some reasonable time before the trial (in treason cases 10 days) ; he summons the witnesses, both for prosecution and defence.

(j) He takes the oath of secrecy, and when the trial is completed, he forwards the proceedings to his Department in London.

K.

Detail the method of packing a driver's kit for **Kit,**
"marching order". **driver's.**

RIDING-HORSE.

NEAR WALLET.	CLOAK.	OFF WALLET.
1 Boot. 1 Stable-bag.	Rolled length of Sword-blade and hilt, in front of saddle ; Cape rolled separately, same length, fastened on top, points of straps to rear. Forage Cap on top of Cloak.	1 Boot. 1 Horse-rubber.

HAND-HORSE.

NEAR WALLET.	OFF WALLET.
Horse-brush and Comb. Harness-brush. Sponge. Oil Tin.	3 Shoe Brushes. 1 Box of Blacking. Horse Brush and Comb.

VALISE—(FLAP TO REAR WHEN OPEN).

NEAR END.	CENTRE.	OFF END.
1 Pair Drawers. 1 Flannel Jacket. 2 Pair of Socks. 2 Shirts. 1 Hair Brush.	1 Stable Jacket, rolled. Account Book and Plume Case in pocket of Valise.	1 Pair of Overalls rolled, with Bible and Prayer Book. Hold-all, Button-Brass and Brush, and Brass-ball inside.
Picker, point to rear, outside near shoe pocket of riding-horse.		2 Towels 1 Cloth-brush } <i>On top.</i>

Corn bag, folded length of valise, and laid on top of blanket cover under sheepskin.

Driver's Kit
(continued)

Wooden canteen under off end of valise, the strap passing outside the near and centre, and inside the off, baggage straps.

T bit rolled inside its reins and secured to baggage strap on near side of pad of Hand-horse.

Nose-bags on off ring of saddle, and near ring of pad.

Mess tin on near side, secured to baggage strap.

I.C.O.'s Kit.

Detail the method of packing a N.C.O.'s kit for "marching order"

NEAR WALLET.	CLOAK.	OFF WALLET.
1 Curry Comb. 1 Horse Brush. 1 Stable Bag. 1 Boot. 1 Oil Tin. 1 Sponge.	Same as Drivers. See p. 127.	3 Shoe Brushes. 1 Box of Blacking. Horse Rubber. 1 Boot.

The Valise is packed in exactly the same manner as the driver's. Great care must be taken in packing it, so that it may not touch the horse's back.

Corn-bag carried in same manner as driver's.

Nose-bag on near side, secured to baggage strap.

Wooden canteen under off end of valise, the end of the strap to be passed round cantle, over fans and under baggage straps. Baggage straps point to the front, buckles on top.

Mess tin on near side, secured to baggage straps.

Knots.

State the use of the more common knots employed in the Artillery service.

(1) *Thumb or over-hand knot*, to tie at the end of a rope to prevent it opening out; to fasten the standing end of the gyn fall to the loop in the double block.

(2) *Right or reef knot*, to secure all lashings where the ends of the rope meet together.

(3) *Draw knot*, same use as reef knot, but ends are doubled back on themselves to undo more easily.

(4) *Running knot*, to bind or draw anything close; also to lash mortars, stores, &c., to their carts.

(5) *Sheepshank*, to shorten a rope without cutting it or unfastening the ends.

(6) *Clove hitch*, to pass round anything to haul on by.

(7) *Timber hitch*, to haul a carriage out of a ditch, or to remove large skidding.

(8) *Single bowline knot*, to throw over a post to haul on; to join two ropes, or sling a barrel.

(9) *Double bowline*, to sling a cask.

(10) *Stopper hitch*, to stopper the *fall* of a tackle, &c.

(11) *Inside clinch*, to fasten a cable to the anchor ring; also standing end of *gyn fall* to lower block.

(12) *Sheet bend*, a very secure method of joining two ropes; also for fastening a rope to a loop.

(13) *Hawser bend*, to join two ropes; easily undone.

(14) *Cat's paw*, a turn made in the bight of a rope to hook a tackle in.

L.

Laboratory compositions.

Into what two classes may the combustible compositions be divided according to their action?

Into detonating and non-detonating.

Sulphur.

Mention the peculiar properties of sulphur, and the compositions for which it is used.

It burns at a low temperature, gives out great heat, and detonates with *chlorate of potash*. For the former reason it is used for all the burning compositions, such as for carcasses, light balls, &c. ; and, for the latter reason, for most of the detonating.

Saltpetre.

What is saltpetre used for?

As a source of oxygen in all compositions which burn in a confined space.

Chlorate of Potash.

Why is chlorate of potash used for detonating compositions?

On account of its property of detonation, on being rubbed or struck, when mixed with sulphur or *sulphide of antimony*.

Sulphide of Antimony.

Explain the use of sulphide of antimony.

It is used with chlorate of potash for its detonating property, and for caps, friction tubes, and carcasses, because it burns with a long flame or flash.

Name another material used for caps.

Fulminate of Mercury.

Fulminate of Mercury. It is also used in B.L. fuze detonators.

What are magnesium and red orpiment used for? Magnesium
For "light" compositions, on account of their burning and Red Or-
with a brilliant white flame. piment.

What is methylated spirit used for? Methylated
For damping detonating compositions, to facilitate their Spirit.
being handled.

What are the leading points to be attended to in making up Laboratory compositions?

- (1) Purity of the ingredients used.
- (2) The proper proportion of each to be accurately weighed.
- (3) Their thorough mixing.

In the case of a gun being laid upon an object above or below it, how would the elevation be affected? **Laying guns.**

If the difference of level be but slight, little or no alteration of elevation would be necessary; if considerable, the elevation must be decreased when the object is below the gun, and increased if above it; for, in the former case, gravity will act as an accelerating, and in the latter as a retarding force.

See **Elevation.**

What means are employed to fire a number of rockets at once? **Leaders, rocket.**

A piece of quickmatch 34 feet in length with nine short pieces, about 4 inches long, attached at intervals of 3 feet; 5 feet of quickmatch are clear at either end. It is called a "Leader".

See **Quickmatch.**

Describe Boxer's life-saving Apparatus.

The rocket is composed of two rocket bodies, one fixed in the prolongation of the other, so that when one is burnt down, a fresh impulse is given by the ignition **Life-saving Apparatus.**

Boxer's Ap-
paratus (con-
tinued.)

of the other. The stick is fixed at the side, and the line passes through a hollow at either end, being knotted at the upper and also near the hinder end.

The machine for firing the rocket consists of a bed to hold it, a pry-pole in the prolongation of the bed, and two wooden legs, right and left. The bed and pry-pole are made of iron, the former rectangular, and the latter rounded. The front of the pry-pole enters and overlaps the bed for a length of 7 inches, and thus affords a rest for the stick. The bed is open behind except where it is connected with the pry-pole by a strengthening bar; it is riveted to the pry-pole by 3 rivets, and has a hinged arrangement with sockets to receive the wooden legs; in the right side is a hole for a portfire and also in the left, in order to facilitate firing, on whichever side may be most convenient. There is a fuze $1\frac{1}{2}$ in. long, which is used with the portfire.

Stores.

The stores are (1) a rocket-line, (2) a hawser on which the sling life-buoy is slung, (3) an endless whip, (4) a double block tackle purchase, for setting taut the hawser, (5) three small spars to form a triangle to raise hawser above water, (6) an anchor to set up the hawser by double block tackle, (7) tally boards with instructions to crew.

The machine has a quadrant and plummet-line to lay it by, and is fired at about 35° .

Use of Ap-
paratus.

When the crew signal that they have got the line, the "whip" is made fast by bending the rocket-line round both returns about 12 feet from tailed block, and then signal to crew. The crew haul this in, and make fast the tail of the block to the highest secure part of the ship, unbend the rocket line, and signal. The two returns of the whip must be kept well apart in hauling the hawser (which is made fast to one return) on board. When the crew get hold of the hawser, they make it fast above the whip.

The "breeches" (or "sling") life-buoy is now adjusted on the hawser by its block, the hawser is led through block of triangle, and set up by "double block tackle purchase", or, if the ship be very unsteady, manned by as many hands as possible.

In urgent cases, the whip alone might be used ; the buoy being passed to the vessel, made fast to one return, and travelling on the other ; in this case the whip would have to be cut.

See **Balls.**

Light balls

What is meant by the "Line of fire", and what by the **Line of Fire**
"Plane of fire" ?

The *line of fire* is the axis of the piece produced.

The *plane of fire* is the vertical plane passing through the axis of the gun.

What is the "Line of sight" ?

The line passing through the two sights (at any elevation), and the object. **Line of Sight.**

Describe the lubricator for B.L. guns.

Lubricator

It consists of three parts, the tinned-iron wad, the felt wad, and the mill-board disc, the first being next the projectile, and the second between the two others. The iron wad is made of two cups soldered together, containing a lubricant of tallow and oil. The felt ring is glued on to the mill-board disc, and the edges of both dipped in bees-wax. It is screwed into the 7", 64-pr., and S.S. 40-pr. cartridges, and choked into the L.S. 40-pr. and lower natures. It is placed between the charge and projectile. Use. The explosion of the charge releases the lubricant, which is carried forward by the felt wad, and the bore is thus cleansed from any residue which might foul it.

M.

Maiming.

When a case of maiming occurs, what course must be adopted ?

A Court of Inquiry must first settle whether the maiming was occasioned by design or not. If the Court report that the injury was by design, with intent to render the soldier in question unfit for the service, he must forthwith be tried before a G.C.M. or a D.C.M. for Disgraceful Conduct.

Malleability.

What is "Malleability" ?

It is that modification of Ductility which is exhibited by hammering ; or the property of being permanently extended in all directions without rupture, by pressure (as in rolling), or by impact (as in hammering).

Marches.

What general principles ought to be observed in arranging the march of an army ?

The army should march in as many columns as possible, and each column on the largest front. When possible, Cavalry and Artillery should march by a different road from the Infantry.

The length of a day's march should not exceed 12 to 15 miles, nor the hourly rate $2\frac{1}{2}$ miles.

Usual Rate of March.

What is the usual rate of marching when moving independently in small bodies ?

Cavalry and Horse Artillery, 5 miles an hour ; Field Batteries, 4 miles ; and Infantry, $2\frac{3}{4}$ miles.

Married Roll.

What conditions must be fulfilled before a soldier can be placed on the " Married Roll " ?

If below the rank of sergeant, he must have completed seven years' service, and be in possession of at least one G.C. badge. Every N.C.O. or soldier previously to his marriage is to obtain the consent of his C.O., and state the name and condition of the woman he proposes to marry. A balance of at least £5 in the regimental savings-bank should also be considered a desirable qualification.

When may a man, married without leave, be allowed to be out of mess ? Men Married without Leave.

In special cases, when the man has children, the C.O. may allow him to be out of mess in order to support his family. This permission, however, is an indulgence, and is only to be granted to men of good character.

What soldiers may be allowed to sleep out of quarters ? Sleeping out of Quarters.

Only those who have received the permission of their C.O. to marry, and who, together with their wives, are of good character.

What are the advantages and disadvantages of marshy ground in front of a position occupied by artillery ? Marshy ground.

The enemy's fire will either penetrate or ricochet but little ; but such ground is an obstacle to the advance of a battery posted in rear of it, as well as to the advance of the enemy.

What is Martial Law, and how does it differ from Military Law ? Martial Law.

Martial Law is that power which, by the custom of the service and necessity, is entrusted to the General commanding an army on active service.

Military Law only affects the persons to whom it specially applies, and in time of peace does not in any way interfere with Civil Law, or the jurisdiction of Criminal Courts.

**Lartini-
lenry.
Lassing
uns.**

See **Small-arm ammunition.**

What points should be specially looked to in massing guns?

The batteries should come into action as nearly simultaneously as possible, otherwise each battery may be crushed in its turn as it comes under the fire of guns which are already in position, and have the range accurately. To fulfil this condition, the batteries should be possessed of great mobility, and their number should not be greater than can act together under the orders of one commander.

**Medals,
loss of.**

What is done in case a soldier's medals are not forthcoming at the weekly inspection of kits?

A board must be assembled to inquire whether the medal or medals were designedly made away with or not; if the board are of opinion that they were designedly made away with, the soldier is to be tried. If convicted, after five years' absence from regimental defaulter's book, he may be recommended to the Commander-in-chief for a new medal, on paying the value thereof. If the loss be proved to have occurred through neglect, the board may recommend that the loser may, after being two years free from the regimental defaulter's book (reckoning from the date of assembly of board), be provided with a new medal at his own expense. If the loss be accidental, the board may recommend that the loser be supplied with a new medal at once, either at his own expense or at that of the public, according to the circumstances of the case. In the latter case, of course, the medal must have been lost when on duty, or by some accident beyond the control of the loser. The board must take evidence as to character of soldier in question.

With Gratuity. See **Gratuities.**

Militia.

In case of a Militiaman enlisting into the regular army can he be tried for desertion?

Yes ; but the Secretary of State for War may issue directions, that in all such cases, any man confessing himself to be a Militiaman shall be put under stoppages of one penny a-day for 18 months, in lieu of being tried ; and, if the man belong to the Militia Reserve he will be subject to a further stoppage of one penny a-day for 240 days ; the man may then be returned to the Militia or retained in the regular army.

Militiaman
Enlisting in
Army.

From what date would the service of this soldier count towards limited engagement ?

From the date of his attestation.

How would his service towards pension be reckoned ?

From the date on which his engagement for the militia would have expired.

Can he recover the service thus forfeited ?

Yes, by having no entry in the regimental defaulter book for 5 years.

What is the standard and age for Artillery Militia recruits ?

Standard as
Age.

Standard, 5' 6". Age, 18 to 35 ; old soldiers up to 45.

What is the term of enrollment and the total bounty ?

6 years ; bounty £6, £1 to be paid at end of each training. Men may re-enroll whilst under age and receive a bounty of 10s. a year in addition.

What is the length of the annual training ?

27 days, with 6 weeks' or two months' preliminary for recruits.

See **Courts Martial**, p.p. 54 and 55.

When subje
to Mutiny
Act.

What is the Militia Reserve ?

By the Militia Reserve Act of 1867, men permitted to

Militia Re
serve.

Reserve (*continued*).

do so by their C.O. can volunteer into a force called the Militia Reserve, the total strength of which is fixed at one-fourth the whole Militia. Men to be regularly attested before a magistrate, for 6 years' service to be spent with the militia, with liability in case of war to be drafted into the regular army, where they must serve until discharged. Total bounty in both Militia and Reserve, £12. Annual gratuity for re-enrollment, 10s. When serving with Militia, men are subject to laws affecting Militia; when in regular army, to the Mutiny Act and Articles of War.

See **Courts Martial**, *p p. 54 and 55.*

Mixed batteries.

What is meant by a "mixed battery", and what are its advantages and disadvantages?

A battery composed of a certain proportion of guns and howitzers.

Advantages—Such a battery is independent as far as possible, being adapted to all kinds of ground, and every circumstance of combat.

Disadvantages—(1) The equipment is very complicated. (2) As the effective range of the pieces differ greatly, the fire of the gun may, under many circumstances, produce great effect, when that of the howitzer is nearly useless, and *vice versa*, so that one nature of piece much be sacrificed to the other.

Moncrieff's carriage.

Describe the Moncrieff carriage.

There are two patterns; in the first the gun is placed in a carriage distinct from the elevator, in the second the elevator itself carries the gun.

Mark I.

In Mark I. the principal parts are the *carriage*, the *elevators* and the *platform*. The *carriage* consisting of iron brackets is supported between the elevators on a strong bolt passing through them from side to side; each bracket has a truck to run on the inclined frame of the *platform*.

The *elevators* are two very large iron brackets with a *Elevators*. box between them to hold the counterweight, they are curved in rear and have teeth to run in corresponding teeth on the horizontal sides of the platform.

The *platform*, of iron, traverses round a central pivot; *Platform*. a self-acting break wheel, working into a cycloidal arc on the elevator, is attached to it to hold the elevators down and to check them in rising.

When the gun is fired the recoil causes the elevators to *Action*. roll back on the platform which raises the counterweight and brings the gun to rest below the parapet; the breaks prevent the gun rising again until released.

In Mark II. which is a modification of Mark I., there *Mark II*. is no carriage distinct from the elevators, and instead of cycloidal racks, there are "retaining racks" on the platform to which the elevators are attached by connecting bars.

Describe the natures and use of the L. and S. service Mortars.
mortars.

Mortars are short pieces of ordnance used to throw shells at high angles. They are made of cast-iron or bronze, the former being intended for garrisons, battering trains, and Naval service, the latter chiefly for sieges.

The cast-iron mortars for L.S. are—

13-inch of 36 cwt.

10-inch „ 18 cwt.

8-inch „ 9 cwt.

For S.S.—

13-inch of 100 cwt. (two patterns.)

10-inch „ 52 cwt.

Used in the bombardment of towns, forts, or works of Use.
any kind.

The bronze mortars are—

5½-inch royal of 1¼ cwt.

4½-inch coehorn of ¾ cwt.

xz- Very useful in the advanced trenches against troops under cover, in the attack of fortified places, or in the attack of entrenched posts, stockades, hill forts, &c.; also in the defence of fortresses, to annoy the working parties of the attacking army.

xr- *How are mortars laid?*

By means of a plummet-line, which is held in the hand immediately behind the mortar, and the string made to coincide with two pickets or rods, on a board placed on the parapet, and directed on the object. A chalk line is drawn on the centre line of the mortar, which is indicated by two notches. and the mortar is traversed until this is in a line with the plummet-string and pickets.

for- *Give an approximate rule for finding range.*

The 13-in. with a 3 lb. charge gives a range of 850 yds., and every additional $\frac{1}{2}$ lb. increases it about 180 yds.; the 10-inch with $\frac{1}{2}$ this charge and the 8-in. with $\frac{1}{3}$ will give about the same range.

The elevation for this must be 45° ; at 15° the range is rather more than half, and at 10° rather less.

Describe the mortar shell.

Calibres, 8", 10" and 13". Gauge much larger than the common. Fuze hole roughed, but not tapped, that of 8" smaller than the others, as otherwise the fuze would touch the bottom of shell. The 13" and 10" have *lugs*, into which hooks fit to enable them to be carried; the 13" have the hooks hung by chains from a beam, the 10" have hand hooks. These lugs are objectionable because the shells cannot be cleaned in a mill, and also they are liable to be knocked off in transport; they will be replaced by *Lewis holes*.

No buttons are used with these shells.

For L.S. loose, the fuze hole closed with a bees-waxed Issue cork, which may be driven in with the 13" and 10" but must be screwed out with the 8" before fuzing.

For S.S. they are issued filled, the fuze hole closed with Sea Service. a cork and kit plaster.

They are completely filled. For practice, blowing charges Blowing are used in red shalloon bags with a brass ring at the Charges. mouth to prevent the bag falling in.

24 and 12-pr. shells are used with the bronze mortars. Bronze Mor- tars. The fuze with these should be bored rather short to ensure bursting before penetration, but with the larger shells it should be bored long.

How are heavy guns mounted?

Mounting

Usually with gyns; where gyns cannot be conveniently guns. placed, the guns may be parbuckled on to the platforms and then raised by lifting jacks. In casemates, overhead gear and jacks would be used, unless they had to be raised too high for such means, in which case building up with skidding would be resorted to. If only one heavy gyn were available to mount a very heavy gun, it can be mounted by building up under the muzzle, and placing the gyn over the cascable.

How is the Mutiny Act passed and of what duration is it?

Mutiny Act.

It is passed annually by Parliament and its duration is limited to twelve months.

In case a man commit an offence against a former Act and be not brought to trial until a new Act is in force, how is he dealt with?

He may be tried and punished as if the offence had been committed against the new Act, provided, that no person can be tried at any period beyond three years after the offence has been committed, unless such person shall

Mutiny Act
(continued).

have absented himself, or there have been manifest impediments to his trial, in which case the time of limitation is two years after the impediment shall have ceased to exist.

When does the Act come into operation?

As soon as received and promulgated. Its receipt is to be published in orders at the station, and the General or Officer Commanding is to acquaint the Civil Governor (if there be one).

Mutiny.

What would you understand by the term Mutiny?

It generally implies extreme insubordination, such as individually or collectively resisting by force military authority.

Persons subject to Mutiny Act.

See **Courts Martial.**

Muzzle-loading rifled ordnance.

Describe the manufacture of the service heavy M.L.R. guns.

The 7-inch may be taken as a type; it consists of—

An inner barrel or tube of steel (A tube).

A B tube.

A breech coil.

A cascable.

A Tube.

The *A tube* is toughened by heating it and plunging it into a bath of oil; it is made from a solid ingot of steel which is rough and fine bored, broached, and has a conical chamber formed in it.

B Tube.

The *B tube* is composed of two coils united together, by facing one and recessing the other, the faucet of one coil being expanded by heat, shrunk round the spigot of the other and both welded together.

The A tube is turned down so as to fit the B tube, and they are shrunk together, then placed in a lathe where they are turned to the proper dimensions, and finally left

standing on the muzzle in the shrinking pit for the reception of the "jacket".

The breech coil or jacket is composed of a triple coil, a Breech Coil, trunnion-ring, and a double coil, welded together. The *triple coil* is formed by coiling three bars one over the other, heating the mass and hammering it on the upper end so as to close the folds longitudinally, and also all round (with a mandril inside) to make it dense. A shoulder 10" long is formed for the reception of the trunnion-ring. The *double coil* is welded in the same manner, and has also a shoulder formed on it for the trunnion-ring. The *trunnion-ring* is a solid forging, punched out by means of a series of taper mandrils; it is made red hot and dropped down on the shoulder of the triple coil, the double coil being dropped into the portion of the trunnion-ring left projecting. The whole mass is then heated to redness, welded under a steam hammer, and turned in lathes. The front of the double coil is recessed to a depth of 8 inches to receive the breech end of the B tube, and a screw cut in the triple coil for the cascable. Finally the jacket is heated for about 10 hours, and shrunk on to the other portion of the gun, consisting of the A and B tubes.

The cascable is forged from scrap iron, a *gas escape* (to Gas escape. warn the detachment in case of the tube splitting near the chamber) is cut on it, and when finally screwed in, it is kept in its place by means of a plug passing through the left side.

The gun is now fine and finish bored, broached, lapped, rifled and vented.

A removable steel cone vent is used before proof, and Vent. afterwards replaced by a cone vent of hardened copper; the object of this is to prevent the proper vent being strained by the large proof charge.

The groove is of the Woolwich shape; both the loading Rifling. and driving sides are struck with the same radius, and the bottom is eccentric to the bore.

8-in. Gun. The 8-inch gun is manufactured in a precisely similar manner, except that it (and all higher natures, except the 13"-05) is rifled with an increasing instead of an uniform spiral.

9-in. Gun. The 9-inch gun differs from these in having instead of the breech coil, a coiled breech-piece composed of two coils united, and a C coil (jacket) composed of a breech coil, trunnion ring, and muzzle coil welded together and shrunk over the breech-piece.

10-in. and higher natures. These natures have an additional piece called the *I B coil* shrunk over the steel tube, between the B tube and coiled breech-piece, for convenience of manufacture, owing to the length of the gun.

As an aid to memory, the different principal parts of the guns may be described according to the familiar illustration and saying, that the 7 and 8-inch guns are clothed in "jacket and trousers," the 9-inch in "jacket, waistcoat, and trousers," and the 10-inch and higher natures in "jacket, waistcoat, belt, and trousers."

Field, Siege, and Mountain Service. *State briefly the construction of wrought-iron and steel guns for field, siege, and mountain service.*

The 64-pr. is similar in construction to the 7-inch ; the jacket consists of a double coil, a trunnion ring, and a single coil welded together. It is rifled with the plain groove.

40-pr. The 40-pr. is identical with the heavier natures ; the jacket consists of two single coils and a trunnion ring welded together. Plain groove rifling.

25-pr. The 25-pr. is similar to the above, but has no cascable screw, the solid end of the A tube projecting beyond the breech of the jacket. Plain grooves.

16-pr. The 16-pr. consists of two parts only, viz., a steel tube and a jacket, composed of two single coils and a trunnion ring welded together. Rifling, French modified.

There are two natures, 8 and 6 cwt. ; they are identical 9-pr. in construction with the 16-pr., except that there is a swell at the muzzle and a dispart patch ; this swell is cut out of the solid steel, except in a few of the first made guns, in which it consists of a wrought-iron ring screwed on. The 6-cwt. gun differs only in having the tangent bar graduated to a slightly longer radius, so that it is not interchangeable with that of the 8-cwt. gun.

The 7-pr. is made from a solid block of steel. Rifling, 7-pr. French.

All these guns, except the 16-pr. and 7-pr. are fitted both for L. and S. service, in the former case the holes for the friction-tube pin and guide-plate are fitted with preserving screws.

What natures of Bronze M.L.R. guns are there in the service, and what is their general construction ? Bronze
M.L.R. Gun

There are two natures of 7-prs. and one 9-pr.

The 7-prs. weigh respectively 224 and 200 lbs. ; there 7-prs. are very few in the service ; Marks I. and II. differ in the latter having the exterior turned perfectly plain, and being 2" shorter in the bore ; the swell of the muzzle is removed and a dispart sight screwed on the gun. They will be superseded by Mark III. of 224 lbs.

The 9-pr. was introduced for Indian service ; it is cast 9-pr. from the usual gun metal, and turned, bored, and rifled in the usual manner, the exterior being perfectly plain and conical from breech to muzzle, except the swell and dispart patch.

What natures of M.L.R. Howitzers are there in the service ? Howitzers.

Two, the 6-3-inch and the 8-inch. They are similar in construction to the 7-inch gun, except that they are shorter and have buttons instead of cascable loops.

See **Principles, Rifling, and Sighting.**

N.

Naval shell. *State differences, if any, between Naval and L.S., S.B. S.B. shell?*

Naval shell differ from common in having the G.S. gauge, and in having their bottoms attached by two rivets. Fuze hole closed by G.S. plug which has no shoulder. The 100-pr. has a top attached in place of a bottom. Generally issued filled, riveted to bottom or top, and fuzed with G.S. percussion fuze. See **Bottoms**.

Rifled? *How are S.S. shell for rifled ordnance issued?*

Filled, fuzed with the Pettman G.S. fuze, and have a papier mâché wad with loop, cemented in over the fuze. The filled shell can readily be distinguished in the dark from the empty ones which have a wad without a loop.

Naval slide. See **Carriages**.

Navez-Leur's chrono-scope. This is an instrument for determining the velocities of projectiles; for a full description of this and other similar instruments, see Owen's Modern Artillery, Appendix IV.

Necessaries. See **Warrant for Clothing**.

Night firing *How do you lay guns at night?*

The gun having been properly laid during the day, the elevation is taken by quadrant or clinometer, and a batten nailed to the platform inside each wheel of travelling carriages, and shorter pieces outside the cheeks at the trail. With standing carriages a directing bar is used, against which the trucks on one side should bear.

Mortars have a piece of wood nailed down along one

side of the bed, or a chalk line drawn on the platform on each side.

An instrument called a *Collimator* is used for laying R. guns. For full description, see *Manual of Artillery Exercises*, Part II., Sec. V.

Name the punishments to which N.C.O.s are liable on conviction by Courts Martial, and the minimum sentence that may be awarded.

Non-Commissioned Officers.

N.C.O.s are liable to the same punishments as private soldiers on conviction by Court Martial. Reduction is the minimum sentence.

What are the duties of Battery Sergeant-Major?

Battery Sergeant-Major

The executive part of the interior economy depends upon him.

He is responsible that the Standing Orders of the regiment are strictly adhered to.

He must be able to instruct the battery in all drills.

He is answerable at all drills for the appearance of the men and horses.

He is to enter in a book the date of shoeing each horse monthly, and to see that the hoofs are distinctly marked.

He is responsible for the accuracy of the battery reports, and for the cleanliness and order of the rooms and stables.

At exercising order he will ride in rear and report any irregularity to the Orderly Officer.

He will back all passes, and attend at the office when men are disposed of.

What are the duties of a Battery Q.-M.-Sergeant?

Battery Quarter-Master Sergeant.

He is in charge of all battery stores, and responsible that they are in the best condition.

He issues the necessaries, and is responsible that they are according to pattern and marked.

M. Ser-
ant (*con-
ued*).

He will attend at all inspections of necessities, arms, &c., by the officers.

He will attend the delivery of bread and meat and the issue of forage, seeing that it is of good quality and proper weight.

He is responsible that the arms, accoutrements, and clothing of any man deserting, going into hospital or dying, are immediately taken account of and put into store.

He will also take into store the necessities, &c., of men in prison, &c.

He will inspect the battery after every field-day, to ascertain loss or damage.

He will frequently inspect the barrack-rooms, stables, utensils, &c., and trace if possible to individuals any loss or damage.

He will immediately report to the Quartermaster any repairs required.

He is responsible that the precincts of the barracks and stables are clean.

He will occasionally visit the married quarters outside the barracks, and report any irregularity to the C.O.

These duties are performed by the Pay-sergeant in a garrison brigade.

Orderly Ser-
ant.

Detail the duties of Brigade Orderly-Sergeant.

(1) To assist the Orderly Officer, and report any neglect on the part of any N.C.O. on brigade duty.

(2) He will parade the sick and prisoners, and see that they are marched by the proper N.C.O.s to hospital.

(3) He will parade the defaulters and inspect their kits. On week-days he will see that they answer their names every half-hour after the last defaulter's call, and on Sunday after half-past 2.

(4) He is responsible that the men in the guard-room are supplied with clean linen, and fit to appear in the orderly-room.

(5) He will parade the canteen orderly at noon, place him on duty, and give him a list of defaulters, visiting the canteen frequently himself.

(6) He will attend to the letter-boxes and the P.O. orderly.

(7) He must see lights out at the proper time.

(8) He is responsible for cleanliness of barrack-yard, &c., and parades cooks for rations.

(9) He will make a report at the close of his duties to the Brigade Sergt.-Major.

O.

Offences. See **Courts Martial.**

Offering violence. *How would you explain the term, "offering violence," and how would you distinguish between it and "threatening language"?*

Any threatening act or gesture amounting to an attempt to use violence, is an offer of violence, if the person at the time of making it has the power of carrying it out. If any obstacle or other impediment would prevent the execution of the threat, the offence would then amount only to threatening language.

"Office, execution of his." *What do you understand by the term "in the execution of his office"?*

A N.C. Officer with his regiment or any part of it is always in the execution of his office. Officers when not on any particular duty, yet may be said to be on duty, that is in the execution of their office, whenever the good of the service requires it; for example, if required to quell a disturbance in mess, &c. In case an officer in plain clothes finds it necessary to interfere for the purpose of putting a stop to some disorder which a soldier of his regiment was committing, he must take care to let that soldier know he is an officer and if it could be proved that the soldier had offered violence to the said officer, knowing him to be an officer, then that soldier could be convicted of offering violence to his superior officer in the execution of his office.

Orderly Sergeant.

See **Non-Commissioned Officers, p. 148.**

State the nature and number of batteries attached to an Army Corps, consisting of 3 Divisions, and a Cavalry Brigade. **Organization of an Army Corps**

(1) Horse Artillery—Four batteries, of which one is R.H.A. attached to the Cavalry Brigade, and 3 are in reserve attached to the Army Corps.

(2) Field Artillery—Eleven batteries in all, viz. :—three R.A. 9-pr. batteries and eight 16-pr. batteries. Of these one 9-pr. battery is attached to each Division; two 16-pr. batteries are attached to each Division, and two are in reserve attached to the Army Corps.

What is the war establishment of men, horses, and carriages, for batteries of R.A.? **War Establishment, R.A.**

	Men.	Horses.	Carriages.
(1) Horse Artillery—	179	179	15
(2) 16-pr. Battery—	198	154	15
(3) 9-pr. Battery—	172	128	15

The Carriages are—6 gun carriages—6 ammunition wagons—1 G.S. wagon—1 store wagon, and 1 forge wagon.

What is the proportion of cavalry and infantry in an Army Corps? **Proportion of Cavalry and Infantry.**

(1) Cavalry—Six regiments, each consisting of a total of 653 men and 604 horses. Three of these regiments are attached, one to each Division, and three compose the Cavalry Brigade.

(2) Infantry—Twenty-one Battalions, each consisting of a total of 1097. Seven battalions are attached to each Division.

What are Outposts?

Outposts.

Outlying picquets posted in advance, on the flanks, and, when necessary, in rear of an army in the field.

Object.*What is their object ?*

With an army they protect it from surprise ; with detachments they do so also, and enable them to retreat without being cut off. They are also used for the purpose of gaining and transmitting intelligence of the enemy's movements and position ; and to act as a screen to the movements of the main army in their rear.

Posts and formation.*How should they be posted and of what formed ?*

As far in advance of the force they are thrown out from as possible, consistent with safety. They are formed either of Cavalry or Infantry or of both. If of the former they should be posted further in advance than those of the latter, they should patrol about, and watch and feel the enemy's outposts to ascertain his movements, &c. The hand with the fingers well opened describes the outpost system, the nails being the outlying picquets, the middle joints of the fingers the supports, the knuckles the reserve, and the wrists the troops or camp to be protected from surprise.

A Battalion on Outpost Duty.*How would a battalion of Infantry be distributed for Outpost duty ?*

In reserve, 4 companies, and on outlying picquet 4 companies, each of these latter 4 companies to be divided into equal portions, one to act as support, the other subdivided into three equal parts, one furnishing the N.C.O. for the reliefs, patrols, &c., and the privates for patrolling ; the other two furnishing 3 reliefs for the double sentries in advance, and for the single one over the arms.

Duties of Officer in Charge.*What are the first duties of an officer commanding an outpost on arriving on the ground ?*

He must carefully examine the space he actually occupies, the heights within musket shot, all roads and paths

leading to or near the post, ascertaining the breadth and practicability for Cavalry and Artillery; he must insure a ready and constant communication with the adjoining posts and vedettes, in the day by signals, and in the night by patrols. He is to examine the hollow ways that cover the approach of an enemy and consider all the points from which he might be attacked. He should strengthen his post when practicable by constructing breastworks, obstacles, &c. He must be prepared for attack from any quarter.

What are the rules to be observed with regard to Sentries. sentries?

Sentries and Vedettes should always be double. They should be frequently visited by the officers and N.C.O.s with the picquets both by day and night, especially at night and in foggy weather when they should be visited between each relief. At night sentries should be on low ground so as not to be seen against the sky line. They should be relieved every hour by night. They must allow only one person at a time to approach their post until they are satisfied that they are friends. The same men should always be posted on the same posts. Single sentries must keep up the communication between the front line of sentries and the picquets, also between the pickets, supports, and reserves. Sentries must at once give the alarm by firing at any body of the enemy approaching their posts, and continue to fire as quickly as possible till driven in, retiring as slowly as possible.

When should Outposts be relieved?

When relieve

About daybreak, because then there will be a double force, at the time when attacks are most commonly made.

What is meant by "Overhauling" a tackle?

Overhaul,
to.

To overhaul a tackle is to separate the blocks. This should invariably be done from the standing and not from the movable block.

P.

*About what is the weight carried by a Pack animal, **Pack animals.** and about what number of rounds of S.A. ammunition will one such animal carry?*

About 206 lbs. exclusive of forage. A mule will carry Load. a weight varying from 200 to 250 lbs.

1200 rounds of Martini-Henry cartridges, packed in two S.A. ammunition boxes, each weighing 78 lbs. Number of Rounds.

The load will then be:—

2 boxes, weight 78 lbs. each	156 lbs.	} Total weight 206 lbs. exclusive of forage.
Pack-saddle	34 "	
Cover	6 "	
Strappings and other articles	10 "	

In loading the animal, care must be taken that the load is well put on, that it is neither pitched too high on the saddle, so as to cause it to roll on the back, nor too low, which adds to the weight; but that the lower line of the load should be even with the shoulders.

Should the country in which an army is operating be unsuitable for wheel vehicles, who decides on the means of carrying the S.A. ammunition?

The commander of the forces decides on the means, and the officer commanding R.A. carries it out.

Packing Stores, &c.
Detail the Method of Packing the Ammunition and Stores belonging to the 9-pr. M. L. R. Gun Carriage and Limber.

GUN.

MODE OF PACKING AMMUNITION AND STORES BELONGING TO THE GUN CARRIAGE AND LIMBER.

LIMBER.

NEAR BOX.
 1 pair drag ropes.
 1 felling axe,
 under footboard.
 1 leather cartouch.

OFF BOX.
 1 swingletree.
 1 bill hook, under.

MID BOX.

1 shovel	
3 common shells. 10 5-sec. wood time fuzes, under.	6 shrapnel shells.
18 filled cartridges in canvas cartouch, 1 fuse pocket with gimlet borer.	
3 common shells. 10 5-sec. wood time fuzes, under.	

1 camp kettle, under.

16 perc ⁿ fuzes.	6 shrapnel shells.
16 perc ⁿ fuzes.	
16 perc ⁿ fuzes.	
20 5-sec. wood time fuzes.	
100 friction tubes.	
2 lanyards.	

1 pickaxe, under.

10 5-sec. wood time fuzes, under.	18 filled cartridges in canvas cartouch, 1 fuse pocket with gimlet borer.	3 common shells. 10 5-sec. wood time fuzes, under.
6 shrapnel shells.		
6 shrapnel shells.		

2 leather buckets, under.

1 spade

On Lid of Near Limber Box.

- 1 gimlet borer.
- 1 plug key G. S.
- 1 tangent scale, 12".*

- On Lid of Off Limber Box.
- 1 fuse extractor.
- 1 gimlet borer.
- 1 clinometer.

NEAR, OR RIGHT
AXLE TREE BOX.

1 drag washer.	1 tin car- tridge box with car- tridge.	1 tin car- tridge box with car- tridge.	2 prickera.
2 sponge cloths.	1 lunch pin.	2 couples.	1 pair plincers.
2 case shot.		2 spikes.	
1 tin cartridge box with car- tridge.			

- 1 sponge.
- 1 traversing
handspike, under.
- 1 tube pocket and strap.
- 1 water carriage brush.
- 1 brush.
- 1 traversing
handspike.
- 1 sponge.
- 1 spanner.
- 1 hammer.

THE GUN

TRAIL

OFF, OR LEFT
AXLE TREE BOX.
Drag Shoe, under.

1 tin car- tridge box with car- tridge.	1 oil can.
1 tin car- tridge box with gun cotton primers.	2 case shot.
1 cylinder with gun cotton primers.	1 tin cartridge box with car- tridge.

1 wadhook worm, under.
Tampoon, with lanyard.

Mark I.

Weight,	R.H.A.
36	1
38	24
38	8
38	17

Mark II.

Weight,	lbs.
36	1
38	0
38	12
38	3
38	17

* When not in use with gun.

† With No. 1 gun.

‡ With 6-cwt gun.

9-pr. M.L.R. Detail the Method of Packing the Ammunition and Stores in the 9-pr. M.L.R. Wagon.

AMMUNITION WAGON.

MODE OF PACKING AMMUNITION AND STORES.

NEAR BOX.

1 half-round grease tin box,
3 lbs., under.

6 shrapnel shells.		
3 common shells. 10 9-sec. wood time fuzes, under.	18 filled cartridges in canvas cartouch.	3 common shells. 10 9-sec. wood time fuzes, under.

1 shovel.

LIMBER.

1 pair drag ropes.
1 picket rope.
1 lifting jack.
1 felling axe.
under footboard.
Mtd Box.

16 perc ⁿ fuzes.
16 perc ⁿ fuzes.
16 perc ⁿ fuzes.
20 5-secs. wood time fuzes.
100 friction timbers.
2 coupes.
1 bayonet.

1 camp kettle, under.

On Lid.

1 funnel, leather.
1 knife.
1 gimlet borer.
1 plug key, G. 8.
1 tangent scale, short (5' or 6'),
spare.*

Ort Box.
1 swingletree.
1 bill hook, under.

3 common shells. 10 9-sec. wood time fuzes, under.	18 filled cartridges in canvas cartouch.	3 common shells. 10 9-sec. wood time fuzes, under.
6 shrapnel shells.		

1 spade.

2 leather buckets, under.

On Lid.

1 drift, wood.
1 gimlet borer.
1 screw driver.
1 pair scissers.
1 tangent scale, 18" spare.*
1 water carriage brush, under
footboard.

Wagon Body.

Forz.
Drag shoe,
under.
1 spare
wheel.

6 shrapnel shells.	3 common shells.
18 filled cartridges in canvas cartouch.	
3 common shells.	3 common shells.

4 reaping hooks.

1 camp kettle, under.	1 skein 6 shrapnel Hambro' shells. line, under.
18 filled cartridges in canvas cartouch.	
3 common shells.	3 common shells.
2 sponge cloths, under.	1 tube pocket and strap, under.
1 skein 6 shrapnel Hambro' shells. line, under.	1 skein 6 shrapnel Hambro' shells. line, under.

1 hand saw, in case, and 3 picket posts.

6 shrapnel shells.	3 common shells.
18 filled cartridges in canvas cartouch.	
3 common shells.	3 common shells.

1 camp kettle, under.

1 lb. slow match, under.	6 shrapnel 4 lb. slow match, under.
18 filled cartridges in canvas cartouch.	
3 common shells.	3 common shells.
2 sponge cloths, under.	1 dummy friction pin, 1 drag washer, under.
1 skein 6 shrapnel Hambro' shells. line, under.	1 skein 6 shrapnel Hambro' shells. line, under.

3 picket posts.

Hind.

1 drill cartridge.†

Box, under, containing—

28 lbs. grease in tin magazine box, under.
1 mail, under.
On Lid of Near Hind Box.

2 portfires.
1 leather holdall, with 2 needles and 2 ozs. worsted.
Under { No. 1, 1 near shaft.
Wagon { No. 2, 1 off shaft.
 { No. 3, 1 spare axletree.

Weight, without tents (Mark L.), 40 cwts. 1 qr. 21 lbs.

On Lid of Off Hind Box.

2 portfires.
1 portfire clipper.

* One each per division.
† Batteries of R.H.A. having only 3 wagons will carry two drill cartridges in the box under off-hind ammunition box, and 1 dummy friction tube, and 1 plug, metal, drill, with lanyard, under the right tray of the off-fore ammunition box. One of the common shells will be kept empty in order that it may be used as a drill shot by means of the metal drill plug and lanyard.

16-pr. M.L.R. *Detail the Method of Packing the Ammunition and Stores belonging to the 16-pr. M.L.R. Gun Carriage and Limber.*

GUN.

MODE OF PACKING AMMUNITION AND STORES belonging to the GUN CARRIAGE and LIMBER.

LIMBER.

NEAR BOX.
1 pair drag ropes.
1 felling axe,
under footboard.

MID BOX.

16 perc ⁿ fuses.
16 perc ⁿ fuses.
80 6-sec. wood time fuses.
75 friction tubes.
1 lanyard.

OFF BOX.
1 swingletree.
1 bill hook, under.

5 common shells.
12 filled cartridges in canvas cartouch.
2 shrapnel shells. 5 9-sec. wood time fuses, under.
5 shrapnel shells.

2 leather buckets, under.
1 pickaxe, under.

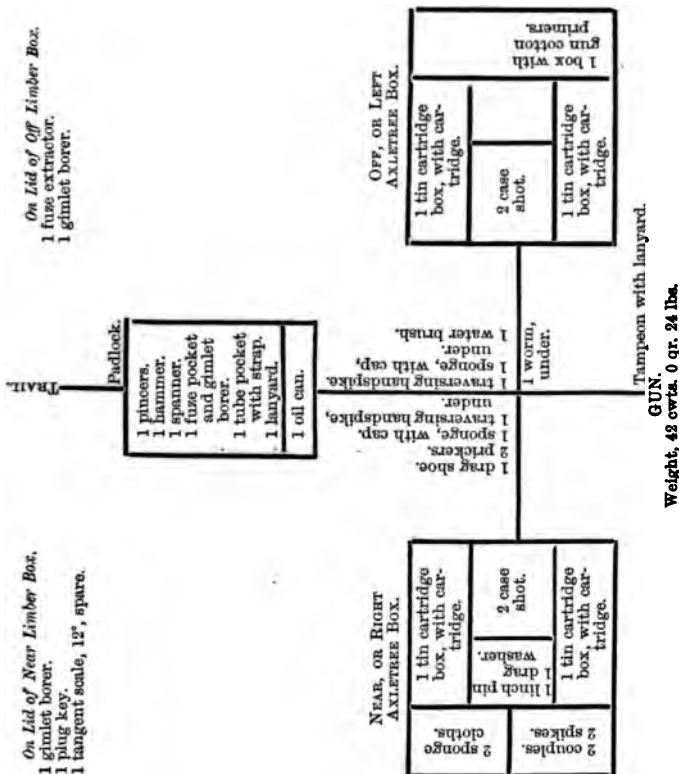
5 common shells.
12 filled cartridges in canvas cartouch.
3 common shells. 5 9-sec. wood time fuses, under.
5 shrapnel shells.

1 camp kettle, under.

1 spade.

PACKING STORES (16-Pr. M.L.R.)

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Note.—A little oakum or leather may be used with advantage to prevent the movement of the projectiles in the boxes.

16-pr. M.L.R. Detail the method of Packing the Ammunition and Stores in the 16-pr. M.L.R. Wagon.
Wagon.

AMMUNITION WAGON.

MODE OF PACKING AMMUNITION AND STORES.

LIMBER.

1 pair drag ropes.
1 picket rope.
1 lifting jack.
1 felling axe,
under footboard.
Min Box.

Off Box.
1 swingletree.
1 bill hook, under.

1 shovel	5 common shells.	5 common shells.
	2 common shells. 6 sec. wood time fuzes, under.	12 filled cartridges in canvas cartouch.
5 ahrapnel shells.		

1 camp kettle, under.

On Lid.
1 funnel, leather.
1 knife.
1 gimlet borer.
1 plug key.

16 perc ⁿ fuzes.
Empty Box.
30 5-sec. wood time fuzes.
75 friction tubes.
2 couples. 1 lanyard.

1 pickaxe, under.

1 drag shoe.

WAGON BODY.

Fore.
1 spare wheel.

1 spade.	5 common shells.	2 ahrapnel shells. 6-sec. wood time fuzes, under.
	12 filled cartridges in canvas cartouch.	5 ahrapnel shells.

2 leather buckets, under.

On Lid.
1 drift, wood.
1 gimlet borer.
1 screw driver.
1 pair of scissors.
1 carriage brush, under footboard.

5 shrapnel shells. 12 filled cartridges in canvas cartouch. 2 shrapnel shells. 5 common shells. 1 camp kettle, under.	5 shrapnel shells. 12 filled cartridges in canvas cartouch. 2 shrapnel shells. 5 common shells. 1 camp kettle, under.	5 shrapnel shells. 12 filled cartridges in canvas cartouch. 2 shrapnel shells. 5 common shells. 1 camp kettle, under.
5 shrapnel shells. 12 filled cartridges in canvas cartouch. 2 shrapnel shells. 5 shrapnel shells. 1 camp kettle, under.	5 shrapnel shells. 12 filled cartridges in canvas cartouch. 2 shrapnel shells. 5 shrapnel shells. 1 camp kettle, under.	5 shrapnel shells. 12 filled cartridges in canvas cartouch. 2 shrapnel shells. 5 shrapnel shells. 1 camp kettle, under.

1 hand saw, in case, and 8 picket posts.

1 portfire stick.

28 lbs. grease in tin magazine box, under.
 On Lid of Near Hind. Box.
 2 portfires.
 1 holdall, with needles and worsted.
 Under { 1 or 4, 1 near shaft.
 Wagon { 2 or 6, 1 off shaft.
 { 6, 1 spare axletree.

Hind.

In box, under—
 1 skein Hambro' line.
 1 skein marine.
 1 lb. slow match.
 4 sponge cloths.
 1 tube pocket and strap.
 1 drill cartridge.
 On Lid of Off Hind. Box.
 2 portfires.
 1 portfire clipper.
 Weight, without tents, 42 cwt. 0 qr. 13 lbs.

1 plug, metal, drill, with lanyard.
 1 fuze pocket and gimlet borer.
 1 dummy friction tube for drill.

40-pr. B. L.
Gun Carriage
and Limber.

Detail the Method of Packing the Ammunition and Stores belonging to the 40-pr. B.L.

LIMBER.

1 pair drag ropes.
1 vent piece (in leather case).

3 swingladders.

Off Box.
1 Mill hook.

Felling axe.

Near Box.
Grease box to contain 3 lbs.

1 shovel.

2 segment shells, with bursting straps, and lifting straps.	1 canvas cartouch containing 5 5-lbs. cart- ridges, with lubri- cators. 15 blank S. A. cartridges, in blue serge bag.
2 filled common shells, with plugs and lifting straps. 1 case shot. 1 fuze pocket.	

1 lubricating can of oil. 1 tin box con- taining 5 9-seca- time fuses. 1 tin box con- taining 16 percussion fuses. 1 tin box containing 25 primers. 1 tin cylinder containing 23 friction tubes.	
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1 spade.

1 canvas cartouch containing 5 5-lbs. with lubricators.	2 filled shrapnel shells, with plugs and lift- ing straps.
2 filled common shells, with plugs and lifting straps. 1 case shot. 1 tube pocket. 1 fuze pocket.	

1 pickaxe.

<i>On Lid of "Near" Box.</i> 1 tangent sight (when not in gun). 3 lanyards. 1 fuse extractor. 1 knife. 1 pair scissors. 1 key iron, plug, G.S. 1 vent bit. 2 borers, gimlet.	<i>On Lid of "Off" Box.</i> 1 tangent sight (when not in gun). 2 instructions. 2 keep pins. 2 common spikes. 2 borers, gimlet.	TAIL. 1 screw jack, with cover. THEM GUN. 1 slot cover. 1 sponge. 1 cleaning rod. DRAG SHOES. Handle of elevating screw. 1 vent piece. 5 handspikes (1 on side, and 4 under trail). 1 sponge bucket. 2 camp kettles. DRAG. 1 hammer. 1 pinners. 1 spanner. WEIGHT. 1 shifting roller. 1 tampon, with lanyard. Weight, about 81 cwt. 2 qrs., with 82 cwt. gun. Do. 84 cwt. 2 qrs., with 85 cwt. gun.
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40-pr. B.L. *Detail the Method of Packing the Ammunition and Stores in the 40-pr. B.L. Wagon.*
 Wagon.
 AMMUNITION WAGON 40-Pr. (32 or 35 Cwt.) B.L.R. GUN.
 (18-Pr. CONVERTED.)

MODE of PACKING AMMUNITION and STORES.

LIMBER.

1 felling axe.
 NEAR BOX.

Grease box to contain 8 lbs.

1 shovel.	1 canvas cartouch containing 6 ½-lb. cartridges with lubricators. 1 funnel, common, leather, large.
2 segmented shells with 3 lbs. slow match.	2 filled common shells with plugs and lifting straps. 1 case shot.

1 water bucket.
 drag shoe.

Box containing 8 sets of horse shoes,
 and 24 sets of nails.

1 pair of drag ropes.
 CENTRE BOX.

1 tin box containing 10 wood time fuses, 9 secs. 2 tin boxes containing 20 percussion fuses. 1 tin box with 25 primers. 1 tin cylinder containing 25 friction tubes.

WAGON BODY.
 spare wheel on perch.

Box containing 8 sets of horse shoes,
 and 24 sets of nails.

1 lifting jack.
 1 swingletree.
 OFF BOX.

1 bill book.

1 canvas cartouch containing 6 ½-lb. cartridges with lubricators.	2 filled ahrapnel shells with primers and fuse plugs and lifting straps. 1 tube pocket (empty) with strap.
2 filled common shells with plugs and lifting straps. 1 akain Hambro' line. 1 case shot.	

1 pickaxe.
 1 water bucket.

FORE.

On Lid of "Near" Box.
 2 borers, gimlet.
 1 portiere clipper.
 4 portiere.
 1 sack portfire.
 1 funnel.

On Lid of "Off" Box.
 2 borers, gimlet.
 2 fuse instructions.
 1 key, iron, plug, general
 service.
 2 needles.
 1 wood drift.
 2 oas, worsted.

5 filled common shells with fuze plugs and lifting straps.	1 canvas cartouch containing 8 5-lbs. cartridges with lubricators.	2 filled shrapnel shells with primers, plugs, and lifting straps. 1 coating sponge.
2 segment shells with bursting straps, and lifting straps.		

2 segment shells with bursting straps, and lifting straps.	1 canvas cartouch containing 8 5-lbs. cartridges with lubricators.	2 filled shrapnel shells with primers, plugs, and lifting straps.
5 filled common shells with plugs and lifting straps. 10 sponge cloths.		

1 hand saw in case.

28 lbs. grease in magazines.
 linch pin and 1 drag washer.
 4 trace couples.
 1 camp kettle.

Box containing 8 sets of horse shoes,
 and 24 sets of nails.
 1 camp kettle.

HIND.
 1 maul.

Weight, about 33 cwt. 2 qrs.

Palliser's projectiles.

Give a general description of Palliser's projectiles.

They are of two natures :—(1.) Shell. (2.) Shot.

(1.) Calibres :—12" (35 ton), 12" (25 ton), 10", 9", 8", and 7".

Shell.

Form, cylindro-conoidal—head, ogival—bottom, flat, in more recent patterns rounded, to facilitate loading. Body, cast in sand—head, in an iron mould—material, mottled iron. The bottom has a wrought-iron bush (in future to be cast-iron) inserted in casting the shell, as the metal is too hard to tap ; a gun metal plug is screwed into the bush to close the filling hole, and a thin ring of lead is hammered into the base to seal the junction of the bush and the metal of the shell.

The shells when they strike an iron object break up and explode without a fuze.

Shot.

(2.) The shot is very similar ; the only differences are that it is a little shorter, and the cavity in the interior contracts more rapidly towards the point. Calibres :—12" (25 ton), 10", 9", 8", and 7".

Use.

Used against iron-clad vessels. It is very doubtful whether the shells would explode if fired against iron vessels not armour-plated, and they would probably fail altogether against wooden ships. Greater penetration, at oblique angles, is claimed for the shot. See **Casting**.

Bursting.

How is the bursting charge inserted ? Explain the probable cause of explosion.

The bursting charge is inserted through the filling hole in the bottom, and is contained in a serge bag, the interior of the shell being lacquered with red lacquer to prevent prematures. See **Prematures**.

On firing, the powder sets back and forms a dense compact mass ; on striking, this is dashed forward into the narrow part of the chamber and probably the friction is sufficient to make it explode.

What is the object of the hollow in the shot ?

Hollow in Shot.

To reduce the liability of the shot to crack or split, as it is very difficult to cast such a dense metal well when quite solid.

What are the peculiar properties possessed by these projectiles ?

Peculiar Properties.

(1.) Intense hardness, obtained by casting the head in a metal chill, hence they are commonly known as *chilled* projectiles. This property prevents the point from flattening in penetration, and gives them an advantage over even steel shot, which are commonly flattened at the point after penetrating.

(2.) Crushing strength, which differs from hardness in a manner which may be explained by comparing glass and iron. The former is hard and will *scratch* the latter, but the iron will *crush* the glass.

(3.) Brittleness, a result of the *chilling*, is overcome by the form of the head.

How are Palliser's projectiles painted ?

Painting

The shell, black with a white tip ; the shot all black.

Describe Palliser's system of converting cast-iron guns.

Palliser's system of conversion

The gun is bored for the reception of the *A tube*, the muzzle recessed and screwed for the cast-iron *collar* (which keeps the tube in position), and the *gas channel* bored through the breech.

The *A*, or *inner tube*, is formed of five coils of wrought-iron united together, bored to the proper diameter, and a recess in the breech, cut and tapped for the wrought-iron *cup*, which is forged, stamped, and screwed tightly home.

A spiral gas channel is cut round the exterior of the *A* tube, communicating with the gas escape through the cast-iron breech.

Gas channel.

**System of
Conversion
(continued).**

The *B tube* which goes over the breech-end of the *A* tube, consists of two coils united, and shrunk on ; it is made double in order that the gas may escape through the channel, without bursting the gun in case of the inner layer splitting.

The tube is fitted into the casing with a certain amount of play, the curved part of the breech end being described with a longer radius than the end of the cast-iron bore, to prevent the tube acting as a wedge to split open the cast-iron. A cast-iron collar is screwed into the muzzle, and a *wrought-iron pin* through a hole under the chase, to keep the inner tube in position.

Venting.

The vent-patch is removed, the old vent is closed with a wrought-iron screwed plug, and a new vent is drilled nearer the muzzle. This is bushed with a *through vent* of hardened copper, screwed into the breech-cup through the barrel, at right angles to the surface of the cup.

Sights.

Sights, same as side sights for 64-pr. M.L.R. No centre sights.

**Guns Con-
verted.**

The guns which have been converted are—the 68-pr. of 95 cwt into 80-pr. of 5 tons ; 8" of 65 cwt. into 64-pr. of 71 cwt. ; and 32-prs. of 58 and 56 cwt. into 64-prs. of same weight.

**Parachute,
Boxer's.**

See **Balls.**

**Parbuck-
ling.**

What is meant by " Parbuckling " a gun ?

To parbuckle is to roll a gun by means of ropes passing round it, the gun resting on scotches sufficiently high to permit the trunnions to revolve.

As the breech is larger than the chase, it advances more rapidly, and must be checked by scotching it up and hauling the muzzle forward, or when on an incline, scotching the muzzle and pinching back the breech.

**Parchment-
certificate.**

What is it, and what does it record ?

A document given to every man on discharge which is either confirmed by the D.A.G., or signed by G.O. commanding and stamped. C.O.s are to record—(1.) The character given by the Board. (2.) Number of G.C. badges. (3.) Class of school certificate—Cause and condition of discharge, and a descriptive statement are also entered.

In cases of discharge, with ignominy, on account of incorrigible conduct, or conviction of felony or disgraceful offences, or on sentence to penal servitude, the lower part of the certificate is to be torn off.

What is the daily pay of N.C.O.s and men in a Field Battery?

	s.	d.	
Battery Sergeant-Major,.....	3	8	and free ration.
„ Qr.-Mr.-Sergeant,.....	3	8	do.
„ Sergeant,.....	2	9	do.
„ Corporal,.....	2	1	do.
„ Bombardier,.....	1	11	do.
Gunner, Driver, or Trumpeter,	1	2½	do.
Farrier Sergeant, ...	3	2	do., and an

allowance of ¾d. per horse per diem.

The free ration is ¾ lb. of meat and 1 lb. of bread.

Name some of the principal offences for which penal servitude may be awarded, and the clauses of the Mutiny Act which specially sanction such punishment.

- (1.) Mutiny and Insubordination. Articles 36 to 38.
- (2.) Desertion. Article 42.
- (3.) Offences in the Field, Camp, Garrison or Quarters. Articles 51 to 58.

Upon what circumstances does the penetration of a projectile depend?

Penetration.

Circumstances affecting Penetration, Velocity at the moment of impact, its weight, form, diameter, material of which it is made, nature of the object struck, and the relative position of this with regard to the trajectory.

Into Iron Plates. *What conclusions have been arrived at, from experiment, with regard to the penetration of iron plates by elongated projectiles?*

- (1.) That the projectile should be made of hard material.
- (2.) That the ogival is one of the best forms of head.
- (3.) With hard projectiles, the probability of effecting perforation is directly proportional to the work in the shot, and inversely to the diameter of the projectile.

(4.) That if the plates be inclined, the effect produced upon them diminishes nearly in the proportion of the sine of the angle of incidence to unity.

(5.) The resistance of wrought-iron plates, up to 5·5 inches, to *complete* penetration by solid steel shot, of similar form and equal diameter, varies as the square of their thickness, nearly.

Mortar Shell. *What is the penetration of the 10-inch mortar shell at a range of 1400 yards into rammed earth, oak, and masonry respectively?*

Into rammed earth, about 27·5 inches.

„ oak, „ 13·7 „

„ masonry, „ 5·5 „

Pensions. *Give a summary of the regulations with respect to Pensions on discharge.*

N.C. Officers and men are divided into 6 classes for pension according to rank. The following shows the classification for the R.A. :—

Classes. Class I.—Brigade Sergeant-Major, Master-gunner, 1st Class Staff-clerk.

Class II.—Brigade Quartermaster-Sergeant.

Class III.—2nd Class Staff-clerks, Regimental Sergeant-Instructor of Gunnery.

Class IV.—Battery Sergeant-Major, Battery Quartermaster-Sergeant, Sergeant, 3rd class Staff-clerk, Farrier, Battery Armourer-Sergeant; Collar-maker and Wheeler, if one of the 4 seniors in the Brigade.

Class V.—Corporal, Bombardier; Collar-maker and Wheeler, after 1 year's probation.

Class VI.—Gunner, Driver, Trumpeter; Collar-maker and Wheeler on appointment.

Pensions are granted as follows :—

(1.) A man discharged at his own request, after 21 years' service, receives a pension varying from 8d. to 1s., the increase from 8d. being $\frac{1}{4}$ d. a-day for every year's service over 21. N.C.O.s who have held the rank for one year previous to discharge receive the following daily addition for every year's service as N.C.O.

Class I. ...	2 $\frac{1}{2}$ d.	Total pension not to exceed	2s. 6d.
„ II. ...	2d.		2s. 3d.
„ III. ...	1 $\frac{1}{2}$ d.		2s. 3d.
„ IV. ...	1d.		2s. 0d.
„ V. ...	0 $\frac{1}{2}$ d.		1s. 0d.

(2.) Pensions on account of incapability, through wounds or injuries received in action :—

	s.	d.		s.	d.
Class I. to IV. from	2	6	to	3	6
Class V. „	2	0	„	3	0
Class VI. „	1	6	„	2	6

For Incapability through Wounds, &c.

On account of incapability, but through injuries of a less severe nature :—

	s.	d.		s.	d.
Class I. to IV. from	1	0	to	3	0
„ V. „	0	9	„	2	0
„ VI. „	0	6	„	1	6

The Royal Bounty of 6d. per diem may be added for Royal Bou gallant conduct.

When discharged through Unfitness.

(3.) For men discharged on account of unfitness after 21 years, the pension varies from 8d. to 1s.; with the following (temporary) additions on account of incapability of earning a livelihood.

Class I. to IV., 6d. V., 4d. VI., 3d.

N.C.O.s receive the same additions as in (1).

After 14 years and under 21 the following are the rates, (permanent or conditional):—

	D.	s.	D.
Class I. to IV.	9	to	1 6
„ V.	7	to	1 2
„ VI.	6	to	0 10

the higher rates being only granted to men who have been 3 years in the class.

Temporary.

(4.) Temporary pensions, on account of unfitness at 6d. per diem for the following periods:—

Under 7 years' service,	1 to 18 months.
„ 10 „	1 to 2 years.
„ 14 „	2 to 3 „
„ 21 „	3 to 5 „

N.C.O.s who have served 3 years as such immediately prior to discharge may be allowed in addition, if in class I. to IV., 4d. per diem, and in class V., 2d.

In special cases a gratuity may be given instead of pension, varying from £1 to £30.

Premature Discharge.

(5.) Premature discharge, after 20 years, 7½d. After 19 years, 7d. After 18 years, 6½d.

G.C. Pay.

(6.) All soldiers are entitled to reckon G.C. pay in addition to pension, the total amount not to exceed—

	s.	D.
Gunner or Driver, ...	1	3
Class I.	Including increase as in (1.)	2 6
„ II. and III.		2 3
„ IV.		2 0
„ V.		1 6

To what pension would a Gunner or Driver with 4 G.C. Examples. badges, discharged at the end of 22½ years, be entitled ?

Ordinary pension for 21 years' service, ... 8d. a-day.

Increase for 1 year's service at ½ a-day, ... ½d. „

„ 4 G.C. badges, ... 4d. „

Total, ... 1s. 0½d. a-day.

To what pension would a Corporal of 23 years' service with 5 G.C. badges, and having been a N.C.O. for 5 years continuously previous to discharge, be entitled ?

Ordinary pension for 21 years' service, ... 8d. a-day.

Increase for 2 years, ... 1d. „

„ for 5 years' service as N.C.O., 2½d. „

„ for 5 G.C. badges, ... 5d. „

Total, ... 1s. 4½d. a-day.

Define the term "Perjury".

Perjury.

It is a "*wilful false oath, by one who, being lawfully required to depose the truth in any judicial proceeding, swears absolutely in a matter material to the point in question, whether he be believed or not*".

Give a form of Charge for Perjury.

Form of
Charge.

Perjury in having at——on or about the——when sworn and examined as a witness before a——Court Martial then being held for the trial of——wilfully and corruptly made the following statement material to the question then at issue before the said Court [*here set out the words used*]; the said statement being false, as he, the prisoner, well knew.

What do you understand by "Pinching" a gun ?

Pinchin

Moving it by small heaves of the handspike, without allowing it to turn on its axis.

Pivots. See **Racers.**

Platforms. Describe :—(1.) *The ground platform.* (2.) *Clerk's platform.*

Ground Platform. (1.) For siege guns it is made of wood with a slope of 1 in 24. Size, 18' $\times$ 10' for large guns, 15' $\times$ 10' for smaller pieces ; 7' 6" $\times$ 6' 6" for mortars, without slope.

For guns mounted in permanent works, it is made of stone, 21' long, 8' broad in front and 16' in rear, with a slope of 1 in 15.

Clerk's Platform. (2.) For siege or garrison guns, it consists of two *inclined planes*, with a slope of 3° for the wheels of the carriage, two *transoms*, two *sleepers*, and a *trail plank* for the trail to rest on. Cut out of a log 17' $\times$ 20" $\times$ 16". The front transom and trail plank have spikes underneath ; the transoms and sleepers are buried flush with the surface of the ground, and the inclined planes and trail plank are placed on them.

Traversing Platforms. Describe the *wooden traversing platform.*

There are three kinds :—(1.) *Common*, consisting of two long *side pieces* placed on four *legs* with *trucks*, which run upon circular *racers* let into the ground ; and on the top of each side piece, a *plank* for the trucks of the carriage to run upon. Slope 1 in 12.

Use. It raises guns sufficiently high to fire over a parapet, when mounted on ordinary garrison carriages with the hind trucks removed and a block of wood substituted.

Advantages. (1.) The gun can traverse through a greater angle than an embrasure will permit.

(2.) The parapet is much strengthened.

(3.) There is more cover for the interior of the work.

Disadvantages. (1.) Guns present a good object for enemy's fire.

(2.) Guns difficult to mount on them.

(3.) Detachments are much exposed.

(2.) *Dwarf traversing platforms*, consist of two *side Dwarf Plat* *pieces*, one *head block*, two *transoms* (middle and rear), one *forms*, one *cross block* under rear transom, two *footboards*, four *battens* between side pieces and transoms for men to stand on, four cast-iron *flanges* and four wrought-iron hollow soled *trucks*, a *bollard* for preventer rope, *eyebolts* for tackle, *plate* in rear with hole for pintail of transporting dilly, and *axletree bands* for the transporting axle. Slope 5°.

(3.) *Casemate platform*, same as dwarf, but lowered by *Casemate Platform* substituting front flanges and trucks for rear ones, which are removed, and front ones replaced by small trucks or rollers in flanges let into the side pieces.

Suitable for all heavy S.B. and B.L. ordnanca.

Use.

For racers, see *Racers*.

Describe the wrought-iron traversing platform.

Wrought-
Platforms.

(1.) The *casemate platform* consists of two *sides*, two *transoms*, two *bottom plates*, two *truck plates*, a *top plate*, a *diagonal stay*, four *flanged feet* and four *trucks*. The sides are of girder-iron, the front transom of plate and the rear of girder-iron, the diagonal stay of plate-iron and formed of a centre piece with four arms like the letter X. The trucks are of wrought-iron, hollow soled, the rear ones having but one flange, on the front side.

A *foot plank* on each side, a *bollard*, front *buffer* and *Fittings*, rear *stops* to check running up and recoil of carriage, *brackets* for side arms, *axletree bands* and *eye plate* for pintail of transporting dilly.

If fitted for *compressor*—brackets to support bars in front and rear, small bracket and stop for *tripper* (which is of iron steeled), and 6 compressor bars.

If fitted for *buffer* (hydraulic)—a *bearing plate* bolted across platform on diagonal stay for front of buffer, and two holding down bands which are bolted, one to this and the other to the rear bottom plate.

Dwarf Iron Platforms.

(2.) *Dwarf platforms*, A, C, and D pivots, are similar to the above except that they are made higher by a different arrangement of trucks and by placing *knee stays*, *packing pieces* and blocks of sabicu, to raise them.

They have also a side step, on each side, bolted from one truck plate to the other.

See **Buffer, Compressor, and Racers.**

**Pleas.
in bar of
trial.**

What pleas in bar of trial could a prisoner offer, which might prove admissible?

That he, the prisoner, is not amenable to military law; or, if a soldier, that the Court is by the Articles of War, incompetent to try the offence with which he is charged; that the Court is illegally constituted, or that the offence took place more than three years ago, he being amenable to justice all that time. A former conviction or acquittal for the same offence, even by civil power, and also previous punishment, pardon, or condonation of the offence, would be valid bars to trial both for officers and men. Want of specification of the charge might, in some cases, be a sufficient plea in bar.

**in bar of
judgment.**

What might a prisoner plead in bar of judgment?

He could plead the pleas already mentioned in bar of trial, or admitting the commission of the act or deed, a plea of absence of intention to commit offence alleged, may be brought forward. The following would be valid pleas:—

1. Insanity at time of committing offence.
2. Accident or mistake. The law is, that if an accidental mischief happen from the performance of a lawful act, the party stands excused from all guilt.
3. Compulsion in obeying what he believed to be the lawful orders of a superior officer; or if he had been compelled to commit the offence under pain of death if he refused.

What is the Pocket Ledger, how is it kept, what entries are made in it, and what becomes of it when a man is discharged, deserts, or dies? **Pocket ledger.**

A small book to show the actual state of the soldier's accounts. It is always to be kept in the possession of the owner, and is to be produced at all kit inspections; his name, number, and regiment to be written legibly on the cover. The C.O. is responsible that each man's account is completed and signed monthly, the C.O. to sign to a credit, the soldier to a debt or when clear. All entries relating to "service abroad", "receipt of clothing", "marriages", "children", becoming "non-effective", and "next of kin", to be signed by C.O.; those regarding "promotion", "wounds" and "distinguished conduct" to be in C.O.'s writing, as well as signed by him.

Religious denomination to be recorded and signed by soldier.

Names of brothers (if any), specifying whether older or younger than soldier, to be inserted.

When discharged, the man takes book with him; in case of desertion it is kept by C.O.; in event of death, forwarded to relations.

When is a gun said to be laid point-blank?

When the production of its axis will pass through the object aimed at; a gun may, therefore, be *point-blank* with reference to an object, yet have several degrees of elevation or depression with regard to the horizon.

Point-blank.

The term was introduced when it was imagined that a shot travelled for some distance in a straight line.

Origin of Term.

What is the point-blank range of a gun?

That obtained at the first graze of the shot, when the piece, placed on its carriage, is fired with the service charge, on a horizontal plane, with no elevation.

Point-blank Range.

Position for battery.

Vide Choice, and Defence.

Portfires. *Describe the portfires used for Artillery purposes.*

Common. Two natures, *common* and *slow*. The first consists of a paper case about 16" long, filled with a composition which burns rather more than one inch a minute.

Slow. The slow portfire is merely paper impregnated with salt-petre, and rolled into a solid cylinder 16 in. long, which will burn two or three hours.

Prematures. *To what causes may premature explosions of shell be traced?*

(1.) Causes connected with the shell.

(i.) Bad lacquer, iron or grit in the shell; in large calibres, from no bag being used.

(ii.) From the shell not being filled (most common with F.S. Shrapnel).

(iii.) From a weak or defective shell.

(2.) Causes connected with the fuze.

(i.) Improperly bored. (ii.) Not home. (iii.) Too high in gauge so as to throw side holes above bush. (iv.) Absence of paper lining where wood has shrunk from composition.

(v.) Powder channels too high and not sufficiently protected by wood of fuze when heavy charges are used.

Preponderance. *Define the term "Preponderance".*

The excess of weight in rear of the trunnions, or, the pressure which the breech portion of the gun, when horizontal, exerts on the elevating arrangement.

How ascertained. *How is it ascertained?*

By supporting the trunnions with steel bars, and bringing the piece horizontal by means of handspikes. A weighing-machine (like the one used at Railway Stations) is then placed under the breech, and a block of wood fixed on it, touching the gun between the elevating points. The handspikes are then removed from bore, when pressure on block is indicated on arm of machine and is the preponderance.

What are the duties of the President of a Court Martial? **Preside**

He is specially charged with the maintenance of proper order in the Court. In District and Regimental Courts Martial, the duties of Judge-Advocate, in Court, devolve on the President; he also summons witnesses when required to do so by the prosecutor or prisoner. At the conclusion of trial the President signs the proceedings, and except in General Courts Martial, he forwards them to the confirming officer.

When has the President a casting vote?

Casting

In the reception or rejection of evidence, and in deciding on the validity of the prisoner's objection to a member. In no other case.

In event of any casualty happening to a President, what is done?

**In event
Casualty**

The next senior member is nominated in the usual manner to take his place.

In what instance may the President of a Court Martial be the officer who investigated the charge or the confirming officer?

**As Conf
Officer.**

Only in the case of a Detachment-General Court Martial.

See **Courts Martial**, pp. 57-60.

What are primers, and what are they used for?

Primer

(1.) A metal cylinder tapped with a screw, with a conical cup-shaped recess in the top, and three fire holes in the bottom, which is covered with shalloon. The body is filled with loose powder.

Screwed into Shrapnel shell by means of two slots in Use. the head, to convey the flash from the fuze to the powder, and to prevent the powder from working up into the fuze socket.

(2.) Tubes of leather paper about $2\frac{1}{2}$ in. long, driven

Vent-piece Primers (continued). with mealed powder and pierced like a friction tube, having strands of red worsted attached to keep them in the holes of the vent-piece.

Use. Used with the 7", and 40-pr. screw B.L. guns. Placed in the horizontal part of the vent-piece before it is placed in the gun, to communicate the flame from the friction tube to the cartridge.

Unscrewing. *How are primers of Shrapnel shell removed?*

By means of a screw driver which is inserted into the slots in the head. The old pattern had four slots, but as the head was apt to give way in unscrewing, there are only two in the pattern now issued.

Priming, gun cotton. *Describe the nature and use of gun-cotton priming for R.M.L. field guns.*

Issued in tin cylinders containing 20 feet of loosely-twisted gun cotton, and strands of silk for attaching.

See **Fuzes**, p. 101.

Principles of construction of rifled ordnance. *What are the two principles on which the science of the construction of Rifled Ordnance depends?*

1. That not only must the whole gun be sufficiently powerful to withstand repeated firing, but the material of the inner barrel must be strong and hard enough to bear the successive strains of discharge. 2. That the gun should be constructed so as to cause each part of its mass to do its due proportion of work at the moment of firing.

How is this second principle carried out by various gun constructors?

(1.) In **Armstrong's** B.L. guns by shrinking on heated coils which contract when cool and thus compress the inner portions of the metal over which they are placed. In his M.L. guns by the employment, in addition, of steel for the inner barrel.

(2.) In **Whitworth's**, a similar effect is produced, by forcing on the outer tubes by hydraulic pressure.

(3.) In **Palliser's** by making the barrel of a stronger material than the outside.

(4.) In the **Rodman**, plan of casting adopted by the United States, in which the hollow casting is cooled from the interior so that the inner portion is compressed and supported by the contraction of the outer.

Name the projectiles used with the various B.L. guns **Projectil**
and their fuzes.

(1.) Common shell—(i.) With 7", 64 and 40-prs.—Fuzes, For B.L. 9", and 20", B.L., Pettman's G.S., and R.L. percussion Guns.
Mark II.

(ii.) When used with 20, 12 and 9-prs., the fuze is the B.L. plain percussion (Navy, E. time in addition, except the 20-pr. S.S. which takes the 9" or 20" and the R.L. percussion).

(2.) Segment shell—(i.) With 7" and 40-pr.—Fuzes, 9" and 20", Pettman's G.S., and R.L. Mark II.

(ii.) With 20, 12, 9 and 6-prs.—Fuzes, B.L. percussion (Navy, E. time in addition).

(3.) Shrapnel shell—(i.) With 64 and 40-prs.—Fuzes, 9", and R.L. Mark II.

(ii.) With 12 and 9-prs.—Fuzes 5", 9" and R.L. Mark II.

(4.) Case shot, with all natures.

Name the projectiles used with the various R.M.L. guns For R.M.L.
and their fuzes. Guns.

(1.) Common shell—(i.) With 12", 11", 10", 9", 8" and 7"—Fuze, Pettman's G.S. (For S.S. the 9", and 20" fuzes may be used when firing 14 lb. charges from the 7".)

(ii.) With 80, 64, and 40-prs.—Fuzes, 9" and 20", Pettman's G.S. and R.L. II.

(iii.) With 25, 16, 9, and 7-prs.—Fuzes, 9" and R.L. II for 16-pr. and 25-pr., and I or II. for 9 and 7-prs.

PROJECTILES.

- (3.) ~~Shrapnel~~ shell—(i.) With 12", 35-ton; 12", 25-ton; 14", 20-ton and 7" S.S. guns—Fuze, 9".
(ii.) With 80, 64, 40, 25, 16, 9 and 7-prs.—Fuzes, 5", 9", and 11".
(iii.) II. for 80, 64, 40, 25 and 16-prs., and I. or II. for 9 and 7-prs.
(4.) Double shell—(i.) With 7"—Fuze, Pettman's G.S.
(ii.) With 7-prs.—Fuzes, 9" or 20".
(5.) Star shell, with 7-pr.—Fuze, 5".
(6.) Case—12", 11", 10", 9", 8", 7" guns and 8" howitzer, and all lower natures.

State the principal advantages of elongated projectiles.

- (1.) The head may have any shape, according to the purpose for which it is required.
(2.) The capacity of the projectile for powder or bullets is increased.
(3.) Percussion fuzes may be made of a more simple character, as it is only necessary to provide for action in one direction.
(4.) The weight of the various projectiles fired from the same gun may be assimilated by varying the length.
(5.) A great saving of powder is effected.

What considerations regulate the length of projectiles for rifled guns and the form of head?

The length will be limited by the twist of the rifling, and is to some extent subordinate to the consideration of bringing them all to the same weight (with certain exceptions). It has been decided that a length of two calibres at least is necessary for very accurate shooting and it is desirable for good destructive effect, on impact, to have the weight great in proportion to the calibre, and of course this is favoured by increased length.

The *form of head* is governed by two considerations, *flight* and *penetration*. Experiment has decided that an

ogival head struck with a radius of 1·5 diameters is the most advantageous form for common shell of all calibres.

See **Head, and Penetration.**

On what is the proof of R.M.L. guns based?

Proof.

On the highest charge the gun will fire on service. R.M.L. Gun
Two rounds of $1\frac{1}{4}$ the highest service (battering) charge, and service projectiles are fired at present; but the future proof of guns firing Pebble powder is to consist of one round with battering charge, and two with proof charges, all three with service weight of shot.

What tests are employed after proof?

After Proof.

A water force with a pressure of 120 lbs. on the square inch is pumped into the bore. This test was instituted for guns with wrought-iron barrels, having loose ends, to ascertain that the breech was perfectly closed, for which purpose it is still used with converted guns. It is also continued in guns having solid ended steel barrels, to make sure that the end has not been split at proof. Gutta percha impressions of the bore are also taken and if any flaws exist of a doubtful or serious nature the gun is subjected to five more rounds with service charges.

Who may be the prosecutor on a Court Martial?

Prosecut

He may be the person who originated the charge, the prisoner's commanding officer, or a staff-officer ordered to perform the duty; in inferior courts, the Adjutant of the prisoner's regiment is usually the prosecutor; in all cases the official prosecutor must be subject to military law. If an officer is to be called as a witness, he ought not to be detailed as prosecutor.

In case of illness of prosecutor during the trial what happens?

Another officer may be appointed.

Punching and racking.

What is the difference between "punching" and "racking"?

Punching is the perforating armour plates by means of elongated projectiles fired with high velocities. Racking is the destroying and shaking off the armour by repeated shocks without penetration, heavy projectiles and low velocities being employed.

Punching is considered far preferable to racking, because it causes more destruction, ensures greater accuracy of fire, and consequently requires a shorter time to effect the desired purpose.

Punishments.

Give all the summary punishments that may be awarded by a commanding officer, and state under what circumstances a soldier may, if he so request, have a right to be tried by Court Martial instead of submitting to the award.

(a.) *Imprisonment or deprivation of pay* to the extent authorized by the Mutiny Act and Articles of War, viz.—imprisonment up to 168 hours and deprivation of pay for any days' absence without leave up to five.

(b.) *Confinement to barracks* for any period not exceeding 28 days carrying with it punishment drill to the extent of 14 days.

(c.) *Confinement to barracks for 28 days without punishment drill*, for concealing disease; with or without an entry in the regimental Defaulter-Book.

(d.) *Extra guards or picquets*, for minor offences or irregularities when on, or parading for these duties.

Appeal to C.M.

A soldier may appeal to a Court Martial from any award affecting his pay.

Q.

What kinds of quadrants are employed in the service **Quadrants.**
for laying guns, and when would they be employed?

The spirit level quadrant and the gunner's quadrant. They are employed to give angles of elevation or depression when you have no sights or when they cannot be used.

Explain the spirit level quadrant and the method of Spirit Level
using it. Quadrant.

It consists of two limbs, a long and short one at right angles to each other; a graduated arc, described with the right angle as centre and smaller limb as radius, connects the two limbs and a spirit level moves on the arc, being hinged at the centre. In order to give elevation with it, the long limb is inserted into the bore of the piece, the spirit level being set to the required angle and the piece elevated until the spirit level becomes horizontal. This gives the elevation above the horizon, but by laying the gun point-blank at the object, and determining its elevation above the horizon, the required elevation may afterwards be given. Angles of depression are taken by reversing the position of the quadrant and placing it against the face of the piece.

Explain gunner's quadrant and method of using it.

Gunner's
 Quadrant.

It is similar to the spirit level quadrant with the exception that there is no spirit level, but a plumb-line is suspended from the right angle. The long limb is placed in the bore, and the muzzle of the gun raised until the plumb-line cuts the required angle on the graduated arc.

Gunner's
Quadrant
(continued).

This as before only gives the elevation above the horizon. The required elevation is given in the same manner as with the spirit level quadrant, and angles of depression taken by reversing position of quadrant and placing it against the face of the piece.

Quarter-
master Ser-
geant.

See **Non-commissioned Officers.**

Quickmatch

What is quickmatch made of and for what purposes is it used?

It is made of cotton wick boiled with a solution of meal powder and gum, a portion of the powder is kept dry and dusted over the quickmatch. When unenclosed it burns at the rate of about 1 yard in 13 seconds; when enclosed in a tube of any kind it burns much more rapidly, being as instantaneous as a train of gunpowder. It is largely used for priming fuzes, making quickmatch leaders, &c.

**Quickmatch
Leaders.**

What is a quickmatch leader and what is it used for?

A "leader" is quickmatch made up in paper tubes and it is used when rapid action is required to fire a number of rockets at the same time, &c. See **Leader.**

Issue.

How is quickmatch packed and how would you demand it?

It is issued either in long packing or in metal lined cases and should be demanded by weight. 1 lb. of six-thread match would be about 360 feet long.

R.

What pivots are used with wooden platforms, and what considerations determine their employment in batteries? **Racers and Pivots.**

The pivots for wooden platforms are the A, B, C, D, E, and F. These may be "actual" or "imaginary". The former are used for heavy guns with compressors; in other cases the imaginary are usually employed.

The pivot, being the fixed point, about which as a centre the platform traverses, is varied according to the nature of the battery in which it is mounted, and the extent of ground which the gun has to cover. In casemates and in batteries with embrasures, it is necessary, in order to keep the embrasure as narrow as possible, to have the pivot in the embrasure, and thus to have very little lateral motion in traversing. In open batteries, where the gun is fired over a parapet, a central or rear pivot is used, the former for salient angles and the latter for a face.

How is an actual pivot formed?

Actual Pivot

By sinking a cast-iron post, with a wrought-iron pin let into the top, in the required position. (This post is generally an old S.B. gun.)

What are the pivots for wrought-iron platforms?

For Wrought iron Platforms.

The A imaginary, the C and D actual, and the Mon-crief I. and II. actual.

What racers are used for wooden and wrought-iron platforms? **Racers.**

For wooden platforms, wrought-iron racers laid with the upper surface raised.

For wrought-iron platforms, similar racers, but with 10" M. L. R. guns and upwards, steel is substituted for wrought-iron.

Can traversing platforms be readily adapted for various pivots?

Yes, by simply loosening the nuts of the bolts of the flanges, setting the trucks to the new radii, and tightening the nuts again.

Racking. See **Punching.**

Range. *Give a definition of "Range". Would your elevation be altered if laying from an elevated point?*

The Range is the distance from the muzzle of the gun to the second intersection of the trajectory with the line of sight.

If the difference of level between the gun and the object be considerable, a greater or less amount of elevation will be necessary according as the object is above or below the gun, gravity acting as a retarding force in firing upwards, and an accelerating force in firing downwards. See **Point-blank.**

Beaming-out guns. See **Smooth-bore.**

Rear guards *Detail the duties of a Rear Guard.*

A Rear Guard is employed—1st. As a small guard to close in a forward movement, to pick up stragglers, and to prevent the enemy from annoying the baggage or carrying off individuals, by means of small parties of cavalry.

2nd. To cover the retreat of an army by retarding the enemy.

Composition. *What should be the composition of a Rear Guard under these circumstances?*

In the 1st case, it should be composed of companies

from several regiments, not of whole battalions, the cooks and a few men to help them being sent on with the main body.

In the 2nd case, it should be composed of from $\frac{1}{4}$ th to $\frac{1}{2}$ th the whole force, and should be formed from the reserves or the freshest troops.

There must be no *impedimenta*, and the wounded should, if possible, be forwarded daily to the front. In an open country all the available cavalry should be employed, and always some of the best infantry.

Sketch briefly the tactics of a Rear Guard.

Tactics.

The great art of rear guards is to force an enemy to deploy for attack as frequently as possible, without much risk or trouble to themselves, and then to retire without serious fighting.

The manœuvres should as much as possible be performed in *échelon*, each *échelon* supporting the other, and retiring alternately.

In retreating over a bridge, care must be taken (when it is to be blown up) that the match to fire the charge is safe from a sudden rush of the enemy, and that all the guns are placed in position to sweep the ground in front.

If hardly pressed, by setting fire to a village in an inclosed country, the enemy will be retarded.

Everything that would be useful as supplies to the enemy such as standing corn, provisions, &c., must be destroyed.

In retreating through a defile, the entrance should be in a Defile disputed, the heights on either side being crowned by troops from the main body.

When the enemy has deployed and begun to scale the heights, the artillery should limber up and go through as quickly as possible. The skirmishers on the heights (from the main body) should be replaced by strong lines from

the rear guard, and then the main body of the rear guard will move off followed by the supports.

Recoil,

See *Carriages*, pp. 23 and 24.

Formula, for
velocity of.

Give formula for ascertaining the velocity of recoil of gun and carriage.

If G = weight of gun.

C = „ carriage.

w = „ shot.

v = the initial velocity of shot.

V = „ „ of gun and carriage.

$$V = \frac{wv}{G + C}$$

This would be a rough approximation; if an accurate calculation were required, the angle of elevation, the rotation of the system, and the friction must be taken into account.

Give formula for recoil of gun alone, and work done on carriage.

If V' = initial velocity of recoil, $V' = \frac{wv}{G}$

The work done may be found by $PS = \frac{WV^2}{2g}$, where

W = weight of gun, V = velocity of gun, and g = force of gravity.

Give formula for velocities of recoil of two guns of equal calibre but different weights.

Let v = velocity of shot, w = weight of shot, W = weight of one gun, W' = weight of other, V = velocity of 1st gun, V' = that of 2nd.

The momentum of each gun will be equal to wv .

$$\text{But } V = \frac{wv}{W} \text{ and } V' = \frac{wv}{W'}$$

or the velocities of recoil are inversely as the weights.

The work done by the guns in recoil, and consequently the strains on the carriage, will be as $WV^2 : W'V'^2$, or by substituting the values of V and V' as $\frac{v^2w^2}{W} : \frac{v'^2w'^2}{W'}$, or inversely as the weights.

In what cases are reduced charges used, and what is their proportion with regard to the service charge? **Reduced charges.**

(1.) In firing red-hot shot: the charge is never to exceed $\frac{3}{4}$ th the service charge.

(2.) In firing at angles of depression; half charge from 15° to 30° ; quarter from 30° to 50° (in order not to dismount the pieces).

(3.) Saluting cartridges for 9" M.L.R. guns and under. In the 9" and 8" the diameters are made less than those of the service cartridges in order to lengthen them and ensure their extending far enough to pass the vent.

State the regulations with reference to the re-engagement of soldiers. **Re-engagement.**

By the 55th Article of the Mutiny Act, any soldier who has commenced the last year of his first term of enlistment, or who, being within 3 years of its expiration, is ordered abroad, may with the approval of his C.O. or other competent military authority, be re-engaged for such period as shall complete 21 years; and at the end of that term he may continue to serve with the approval of competent authority.

Soldiers who have taken their discharge at expiration of limited engagement, may be permitted to re-engage, provided they do so within 12 months from date of discharge, are of good character, and under 34 years of age. Soldiers who have declined to re-engage abroad and have been sent home at the public expense will not be permitted to re-engage in this country.

**Remission
of Sentence.**

What are the present rules with reference to remission of sentence by Court Martial?

The confirming authority has the power, at any time, of remitting any portion at discretion. The periodical visitors of military prisons have the power of recommending remission of punishment. When a prisoner confined in a military prison is recommended for a remission of punishment by his C.O., the recommendation should be submitted for the approval of the periodical visitors.

If a soldier's punishment has been wholly remitted what effect has it on forfeiture of service, &c.?

There is to be no remission of any penalty consequent on his conviction, such as forfeiture of service, G.C. pay, &c.

**Reserves,
ammuni-
tion.**

By whom are Reserves of gun ammunition carried in the field and how many rounds per gun are available for a two days' action?

The first and second Reserves are carried by the R.A., the third by the Control Department.

300 rounds per 9-pr. gun and 280 per 16-pr. gun.

**Detail of the
Reserves.**

Give a detail of these three Reserves.

The 1st Reserve carries 108 rounds per 9-pr. and 72 per 16-pr. gun.

The 2nd Reserve, 44 per 9-pr. and 108 per 16-pr. gun.

The 3rd Reserve, 200 per 9-pr. and 200 per 16-pr. gun.

**Position of the
Reserves.**

What are the positions for the Reserves?

The 1st with the Division, the 2nd with the Army Corps, the 3rd two days' march off, or if further, with intermediate depôts.

**Ammunition,
how Carried.**

How is the ammunition carried?

The 1st Reserve, for 9-prs., in 3 limbers and 6 G.S. wagons; for 16-prs. in 4 limbers and 7 G.S. wagons.

The 2nd Reserve, for 9 prs., in 9 G.S. wagons ; and for 16-prs. in 42 G.S. wagons.

Where are the 1st, 2nd and 3rd Reserves S.A. ammunition carried, what is their amount and who is in charge ? S.A. Ammunition.

The 1st with the 1st or Divisional R.A. Reserve, the 2nd with the 2nd or Army Corps R.A. Reserve, and the 3rd placed in a dépôt two days' march off, or if further, with intermediate dépôts.

The 1st S.A. Reserve consists of 40 rounds per man and the 2nd of 40 rounds also, both in charge of the R.A., the 3rd of 300 rounds is in charge of the Control Department.

What are the duties of officers in charge of Reserves of ammunition ? Duties of Officers in Charge.

The 1st Reserve is under all circumstances to be at hand, and when necessary to separate the S.A. ammunition carts from the Divisional Reserves to which they are attached, the Divisional C.O. of R.A. must arrange for their being placed in some safe spot, easily accessible to the troops.

The 2nd Reserve is always to be kept up with the army but as far as practicable out of fire. Officers in charge will be responsible that the 1st Reserve is from time to time completed from the 2nd Reserve.

These two Reserves are to be completed from the 3rd, upon requisitions of O.C. R.A., supported by receipt vouchers for issues made to the troops.

On emergency, the Control will make issues on requisitions from officers commanding the R.A. Reserves.

How is the S.A. ammunition carried ?

The 1st or Divisional Reserve, in 29 carts.

The 2nd or Army Corps, in 36 G.S. wagons.

S.A. Ammunition, how Carried.

Proportion
per Man and
per Gun.

As a general rule what is the proportion of ammunition supplied to an army in the field: (1) Per man: (2) Per gun?

(1.) 70 rounds in his own possession, + 30, Regimental Reserve, + 40, 1st Reserve, + 40, 2nd Reserve, + 300, 3rd Reserve = 480 rounds per man.

(2.) 148 rounds with the battery, + 108, 1st Reserve, + 44, 2nd Reserve, + 200, 3rd Reserve = 500 rounds per 9-pr. gun. 100 rounds with battery, + 72, 1st Reserve, + 108, 2nd Reserve, + 300, 3rd Reserve = 480 rounds per 16-pr. gun.

**Reserves,
Army.**

See **Army, Militia, and Volunteers.**

Ricochet.

What is meant by the term "Ricochet"?

Ricochet fire consists in placing a battery at right angles to the line of troops or works aimed at, as in *enfilade*, but the shot having to clear a parapet, it is necessary to fire with reduced charges and greater elevation, to give the shot a low velocity and high curve, in order that it may be brought down immediately after clearing the crest of the parapet, and rebound along the face of the work.

**R.M.L.
guns.**

See **M.L.R.**

**Rifling, sys-
tems of.**

Into what classes may the systems of rifling generally adopted be divided?

(1.) Muzzle or B.L. guns having projectiles of hard metal, fitting the peculiar form of the bore mechanically. The **Whitworth** and **Lancaster** guns, the former of which has a hexagonal bore and projectile, and the latter a bore and projectile in the form of a twisted ellipse, are types of this class.

(2.) Muzzle or B.L. guns with projectiles having soft metal studs or ribs to fit the grooves, as in the *French* and *Woolwich* systems.

(3.) B.L. guns with projectiles, having a soft metal

envelope or cup, which is expanded by the gas in the bore.

(4.) B.L. guns with projectiles, having a soft metal coating larger in diameter than the bore, but which is compressed by the gas into the form of the bore, as in the **Armstrong** and **Prussian** systems.

Name all the forms of rifling used for M.L.R. guns in the service.

Service
M. L. R.
Rifling.

(1.) Woolwich, (2.) Plain groove, (3.) French, (4.) French modified; and (5.) Shunt, which will be gradually abolished, but a large number of guns still retain it.

Describe the Woolwich groove.

Woolwich
Rifling.

Both the loading and driving edges are struck with the same radius; the bottom is eccentric to the bore. They are the same width for all natures, except for 10" and upwards, when they are widened at the muzzle to facilitate loading.

Width about 1"·5, depth 0·18".

Describe the Shunt groove.

Shunt Groove

The depth and width vary at different parts, the object being to provide a deep groove for the studs of the projectile to travel down when the gun is being loaded, and a shallow groove through which they must pass when the gun is fired, so that the projectile may be gripped and centered. This is attained by making the driving side shallow near the muzzle. The projectiles have soft copper studs which fit easily into the deep portion of the groove; when the gun is loaded the studs travel down this, until they meet with an incline by which they are shunted into a narrower part of the groove, down which they travel to the chamber. On discharge, they bear against the other side of the groove until, within a certain distance from the

muzzle, they come to an incline up which they travel and are thereby compressed.

Plain Groove

Describe the plain groove.

This is the narrow deep part of the Shunt groove continued to the muzzle without the Shunt or incline. The edges are angular and are slightly rounded off. Adopted in order that the Shunt ammunition might be fired from all 64-prs.

French modified.

Describe the French modified groove.

The driving side of the groove forms an angle of 70° with the surface of the bore, and the loading side is at right angles to the driving side. The bottom is eccentric to the bore and the corners rounded off.

The object is, that the studs may run up the greater incline on the driving side, and thus being gripped, effect the centering of the projectile.

French.

Describe the French groove.

This differs from the modified French in not having the corners rounded, and in the bottom curve being described concentric with the bore.

Rifling Howitzers and Mortars.

What difficulties attend the rifling of large howitzers and mortars?

On account of their shortness and large calibre it is difficult to give a sufficient velocity of rotation to the projectile, and to centre it, without making the twist of the grooves too sharp. See **Twist**.

Rifling, Principles of.

What objects are attained by rifling a gun?

The accuracy of fire is increased and longer ranges are obtained by the use of elongated instead of spherical projectiles.

Why is a rifled shot more accurate in flight than a S.B.? Accuracy of Rifled Shot.

Because a rotatory motion is given to it, on an axis parallel to that of the bore or coincident with the line of fire, whereby the shot is *centered*, and the velocity of rotation counteracts the pressure of the air tending to turn it over or render it unsteady in flight. See **Centering**.

Why is it that with a smaller charge of powder, a rifled shot ranges further than a S.B.? Greater Range.

Because, although an elongated projectile has a lower initial velocity, it exposes less surface to the resistance of the air, and does not lose its velocity so rapidly as a spherical projectile.

See **Velocity**.

On what does the velocity of rotation requisite depend? Velocity of Rotation.

Upon the initial velocity, the length, form, density, distribution of material, and position of C. of G.

Explain this briefly.

As the I.V. is increased, so will the resistance of the air tending to turn over the projectile be greater. Long projectiles require a more rapid rotatory motion than short ones of equal weight, because the resultant of the resistance of the air acts with greater leverage as the length of the shot is increased.

A flat-headed projectile requires a greater V. of rotation than a conoidal or ogival one, because the current of air meeting it, instead of passing round it, as with a pointed shot, exerts a much greater proportional force tending to upset it.

The greater the density, the less will the V. of rotation of a shot be decreased by the resistance of the air.

A hollow elongated projectile will be steadier during flight than a solid shot of equal weight, because the mass

Velocity of Rotation (*continued*). being distributed further from the axis, the radius of gyration is lengthened.

If the C. of G. is far forward, there is little fear of the shot turning over even with a low V. of rotation, but to prevent any "*wabbling*" motion a rapid rotatory motion should be given.

Should the C. of G. be near the base, a very high V. of rotation must be given to make the shot proceed point first.

Why is a very high V. of rotation objectionable?

Because the strain on the gun is very great, as the charge must be large and the grooves will require a sharp twist, much resistance being thereby caused to the motion of the projectile; should the projectile be a Shrapnel or segment shell, the pieces would spread laterally too much, and in any case the projectile would deflect considerably after grazing.

Riot.

Define a "Riot".

Any number of persons amounting to 12 or more, unlawfully, tumultuously and riotously assembled together to the disturbance of the public peace.

Rockets.

What rockets are used in the service?

Signal rockets of 1 lb. and $\frac{1}{2}$ lb., and Hale's war rockets of 9 lbs. and 24 lbs.

Signal Rockets.

Describe the signal rockets.

The case is made of thick brown paper, rolled up into a cylinder, the composition is driven in by hand, and the conical hollow made by a "former".

Head, cone shaped, made of light paper, containing the stars, and mealed powder to open it and scatter the stars. This chamber is separated from the composition, by clay with a hole through it. The rocket is choked near the base and primed, the vent covered with paper.

Stick attached by copper socket.

Firing Sign
Rocket.

Fired from a machine, consisting of two tubes, one for the rocket body and the other for the stick, by means of a quill tube. May be fired, however, from a T frame, a nail in a post, or with the stick stuck in soft ground.

Describe Hale's rockets.

War Rocket

Made of atlas metal, formed into a cylinder corrugated in three places, to give the composition a better hold. Head, cast-iron, filled with oak, secured to body by rivets.

Composition, separated from head by mill-board disc and from base by mill-board washer, pressed in by pellets, and a conical hollow bored.

Base of case, closed by a cast-iron ring, tapped to receive a tail-piece of cast-iron, with 3 conical vents with the larger part of the cone towards the interior. The vents are cut away on one side, so as to leave three projecting wings against which the gas acts and causes the rocket to rotate.

Describe the Machine or Trough for firing Hale's rockets.

Machine
for Firing
Rockets.

A sheet-iron V trough, supported at rear by 3 legs made of wrought-iron tubing, two short ones opening right and left, and one long one to the front. On the front one runs a gun-metal ring, connected by two bars with a V near the front of the trough; the elevation is given by sliding the ring up and down the front leg (which is graduated to the required degree), and clamping it.

What is the object of the hollow in the rocket composition?

Hollow in
Composition.

That a large surface of composition may be at once ignited when the rocket is fired, and so great a quantity of gas generated within the case that it cannot escape from the vent as quickly as formed, and therefore it exerts a

**Object of
Hollow** (*continued*).

pressure in every direction on the interior surface. The pressures on the sides mutually balance each other, but the pressure on the head is greater than that on the base, in consequence of the escape of gas from the vents, and it is this excess of pressure which causes the rocket to move forward.

**Life-Saving
Rocket.**

See **Life-saving Apparatus.**

Rotation.

See **Rifling.**

S.

*What do you understand by the term "Safeguard", and **Safeguard** explain the meaning of "forcing a safeguard"?*

A safe conduct or safeguard is sometimes for special reasons granted to the persons or property of an enemy by the General in command of an army. It protects from molestation or capture.

By the law of nations, a safe conduct or safeguard has ever been respected as a national point of honour. A person would be guilty of "forcing a safeguard" if he ignored the fact of the safeguard and treated the parties holding it as enemies, or pillaged the houses, &c., protected by it.

It would be a contemptuous violation of supreme authority, and would bring in question the good faith of the General who gave it.

*What is the maximum annual deposit on which interest **Savings-banks.** is allowed?*

£30 (exclusive of interest added).

What is the maximum and minimum deposit allowed?

£200 (inclusive of interest added) is the maximum, and 1s. is the minimum deposit.

What is the rate of interest allowed?

Rate of Interest.
£3 15s. per cent. per annum; no interest is allowed on other parts of a pound than 6s. 8d. and 13s. 4d., nor on sums that have not remained in deposit 1 month.

How often is the interest added to the principal?

Quarterly, and thenceforward bears interest.

What notice must a man give when he wishes to withdraw any money?

At least 7 days. If the C.O. considers it for the advantage of the man, this may be dispensed with.

When a soldier is convicted of desertion or recorded by a Board as a deserter, what becomes of his deposit?

It is forfeited to the public.

School-masters.

Name the special punishments applicable to School-masters.

By the 137th Article of War, an army Schoolmaster may be sentenced to dismissal or loss of service, but not to reduction.

Screw, elevating.

See **Elevating.**

Sedition.

Explain the meaning of "Sedition".

Sedition means acts of a treasonable or riotous nature directed against the civil government with intent to overthrow it.

How should the crime of Sedition be proved?

By acts, not by words, or by words at all, except in connection with acts.

Segment shell.
Use.

With what guns are segment shell used?

With all B.L.R. screw guns, and with the 40-pr. wedge guns.

Description.

Describe the segment shell?

It consists of a very thin cast-iron cylindro-conoidal shell lined with cast-iron segments built up in layers, having a cylindrical powder chamber in the centre. The base is closed with a cast-iron disc. A thin coat of alloy of lead extends from base to shoulder, it also is allowed to flow in between the segments and lines the powder

chamber. The lead coating is .05" deep over body and .1" over base, a cannellure running round the shell to take any lead stripping off the front part. The lead is attached by zinc solder. Every segment shell has four longitudinal grooves in the interior of the head. The shell is strong against external pressure, whilst a small bursting charge will open it.

What is the object of the increased diameter at base ?

1. To prevent windage.
2. To enable projectile to be gripped simultaneously at shoulder and base on ramming home.
3. To retain the grip until the base leaves the muzzle.

What is the length of the segment shell, and how is the bursting charge held in the F.S. patterns ? Length of Shell.

The length approximates to a little over two calibres. The bursting charge is contained in a wrought-iron gas-pipe burster which is dropped into the powder chamber.

How are F.S. segment shells carried ?

How Carried

Filled, with a serge-covered wooden plug over the burster to keep it from shaking about ; the B.L. field service gun-metal plug is then screwed in.

For what purposes are they specially adapted ?

Purposes adapted for.

Against troops in column they are very effective, and should be burst close to them. They are also good for firing against troops behind a thin wall. They should always be fired with percussion fuze as a time fuze is nearly useless with them.

What is meant by the "Scoring" of the bore of a piece of ordnance ? Scoring.

The injury to the upper surface of the bore by the rush of gas over the projectile. It arises from windage, and occurs only in rifled ordnance.

Repair of M.L.R. Guns. *How would you repair bores of M.L.R. guns damaged by scoring?*

The original vent should be plugged up, and gun bouched and re-vented in the under side which then becomes upper.

Sergeant-Major. See **Non-commissioned Officers.**

Shells. See **Common, Segment, &c.**

Shrapnel shell. *What sorts of Shrapnel shell are there in the service and with what ordnance are they used?*

Diaphragm Shrapnel used with S.B. guns, and Boxer Shrapnel with Rifled guns.

Diaphragm Shrapnel. *With what natures of ordnance are diaphragm Shrapnel shell used?*

They are fired from Guns, Howitzers, and Carronades. All calibres except 10".

Description. *Describe the shell.*

The shell is a thin cast-iron shell weakened by four grooves down the sides to make it open out, thickened at the junction of the diaphragm and shell, at the fuze-hole to support the socket, and at base to withstand the shock of discharge. A wrought-iron cup or diaphragm divides the shell into two unequal parts, the smaller forming the powder-chamber, and the larger being filled with lead and antimony bullets packed in coal dust. A gun metal socket passes through the diaphragm and contains the fuze. The bullets are inserted through this socket, and the powder for bursting charge, through a loading-hole. It is most destructive against troops in column, but may be used against troops in line.

Use.

Boxer Shrapnel Shell, B.L.O. *What classes are there of Boxer Shrapnel shell for B.L.O.?*

Classes. Two classes—1. Garrison or Naval. 2. Field or Boat.

Describe the garrison or naval Shrapnel shell and state what guns it is used with. Garrison or Naval B.L.

It is used with 64-pr. and 40-pr. Gauge G.S. Each shell consists of a hollow body with a head lightly attached to it. Body, of cast-iron with lead and antimony coat to take grooving. The body is weakened internally by six longitudinal grooves running down the entire length of the interior. The base is formed into a chamber to hold the bursting charge—interior of body is slightly conical. A tin cup is placed in chamber to contain the powder. Over the mouth of powder-chamber rests a disc of wrought-iron supported by a shoulder, the disc is pierced in centre and partly tapped to take a wrought-iron tube which is screwed into it, this tube being tapped at top to take a gun-metal primer. On the diaphragm are placed bullets of lead and antimony fixed by rosin run in among them. Over bullets and rosin is a kamptulicon disc. The head is made of elm covered with a light shell of Bessemer metal, the wood being bored out to contain a tin socket fitting round the iron tube of the body and holding in its mouth a gun-metal bush of G.S. gauge tapped to take G.S. screw plug. The head is attached by 12 steel rivets in larger, and 4 in smaller shells, and 4 steel twisting pins. The 64-pr. Bessemer head fits into a groove in top of body, and the tube is surrounded by a hollow elm-wood cylinder. Sides of shell are lined with brown paper.

Describe field or boat Shrapnel shell and state what guns it is used with. Field or Boat B.L.

It is used with 12-pr. and 9-pr. Gauge G.S. Same construction as garrison shell except that the rim of cast-iron is thickened and the Bessemer metal of head turned down to a corresponding amount at the junction. The head is attached by screws as well as rivets to prevent its becoming detached by jolting in limbers. A gun-metal

tube with an enlarged head is substituted for the iron one, thus preventing the primer from becoming fixed by corrosion; and to head of tube a tin socket is soldered to prevent the rosin from working up.

**Shrapnel
Shell R. M. L.
Ordnance.**

Describe Shrapnel shell for R. M. L. ordnance and state what guns is it used with.

It is used with all M. L. R. guns except the 11-inch, and with the 8" howitzer. Gauge G. S.

**For 12-inch,
35 ton; 12-
inch, 25 ton;
10-inch, 9-
inch, 8-inch
and 7-inch.**

The shell for the heavy guns from 7-inch inclusive (except 11-inch) are only issued for S. S., but would be available, if necessary, for L. S.

The construction resembles that of B. L. Shrapnel shell, garrison service, except that the body of the shell is thicker and the walls increase slightly in thickness from top to base. At base the shell contracts, forming powder-chamber; a slightly recessed groove runs round the top of the shell near the exterior surface to receive the Bessemer metal head. The wrought-iron pipe down centre of shell is lacquered internally. The fuze-socket fits into upper portion of this pipe; the diameter of the pipe is large to facilitate loading and unloading. The interior of shell is filled with sand shot for economy. The top of the Bessemer metal head is bent down to form a shoulder for socket which is flush with head of shell. The socket is tapped at base to receive primer and at top for G. S. plug. Holes are bored into the head to take small tin sockets, which are fitted into the wooden lining and form extractor holes. There is no lead coating for shell but studs same as for common shell.

**For 8-inch,
Howitzer.**

The shell for the 8" howitzer is the same as that for 8" gun except that it is studded to suit the quick uniform twist of the howitzer.

**For 64-pr., 80-
pr., 40-pr., &
35-pr. Guns.**

For the 64-pr., 80-pr., 40-pr., and 25-pr. guns the Shrapnel shell is the same internally as that for the 64-pr. B. L. gun, differing from it in having studs, ex-

tractor holes, &c. The socket is flush with the top ; a strong gun-metal socket replaces the composite socket of tin and gun-metal which serves to receive fuze ; the bottom of socket is tapped to receive the brass primer, the iron tube fits on to the end of the fuze-socket, and is made larger in diameter, and the underside of the diaphragm, and top of tin cup are shaped conically.

For the 16-pr. gun the Shrapnel shell about to be introduced has no grooves, and has the coned cap and diaphragm ; studs are of pure copper ; otherwise it resembles the 9-pr. and 7-pr. Shrapnel. For 16-pr. Guns.

For the 9-pr. and 7-pr. guns the Shrapnel shell resembles the B.L.F.S. Shrapnel, except that it is studded ; the latest patterns have a flush instead of a projecting socket, and the longitudinal grooves are omitted in the 9-pr. in order to strengthen the shell. For 9-pr. & 7-pr. Guns.

How should F.S. Shrapnel be made to burst ?

Use with
Fuzes.

They should burst closer to compact bodies of troops than to more open formations. To have good effect they should burst well within 100 yards of the object (as a rule about 50 yards) and from 10 to 15 feet above plane.

When might percussion fuzes be employed to advantage with Shrapnel shell ?

With Per-
sion Fuzes

When firing against dense masses of men or against Artillery. At long ranges the percussion fuze does not answer well.

See **Case, Hollow, &c.**

Shot.

What precautions should be taken in firing a gun with red-hot shot ? Red-hot Shot

A dry junk wad is put into gun next to cartridge, and then a wet one ; the shot is then rolled in. The gun when loaded should be fired as quickly as possible. If the shot remains long in the bore, the metal of the gun at seat of

shot becomes heated, and the mass unusually expanded; the particles being thus disarranged, when the gun is fired it is very likely to burst.

Expansion of Red-hot Shot. *What is the expansion of a red-hot shot in terms of its diameter?*

From $\frac{1}{80}$ to $\frac{1}{100}$.

Shrinkage. *Give definition and explanation of the term "Shrinkage".*

When two coils are prepared for shrinking together, the excess of the exterior diameter of the inner coil above the interior diameter of the outer one, both coils being cold, is termed "shrinkage".

In order to shrink the two together, the outer must be expanded by heat until large enough to drop over the inner one where it is allowed to cool and contract. The result of this is that the inner becomes "compressed", and the outer remains in a state of "tension". The shrinkage is equal to the compression *plus* the tension.

Sieges. *What are the principles which regulate the organization of a siege equipment?*

The plan and probable number of guns in the place to be attacked, state of fortress and of its armament at period of siege, and the strength of garrison which defends it. These having been ascertained approximately, the chief points to be decided are, the nature and quantity of ordnance required for the siege, and the proportion of ammunition which the length of its duration is likely to demand.

For ordnance employed, see **Armaments**.

Number of Rounds. *How would you estimate the number of rounds for each piece of ordnance?*

The number of rounds for each piece of ordnance should not exceed that which is calculated to render it unserviceable. See **Armaments**.

*What would be the number of carriages required for a Number 6
siege train of 105 pieces?* Carriages.

Carriages for ord- nance, travel- ling, with siege limbers.	Iron, {	rifled gun, { 64-pr. ... 25
		40-pr. ... 20
		rifled Howitzer 8" ... 30
	Wood, rifled gun, 64-pr. ... 30	
Trench carts, ...		105
Limbers for slides, ...		8
Wagons, {	Forge, ...	10
	Store, ...	63

What stores would be needed?

Stores.

One gun to every four 7" guns, and large proportions of handspikes, skidding, tackles, ropes, &c., &c. The proportions are detailed in Revised Army Regulations, Vol. III., Corps Equipment, Part I., Section I.

What regulates the amount of powder, fuzes, &c.?

Powder,
Fuzes, &c.

It is determined not only by the number of rounds per gun, but also by the charges employed, and varies according as these are intended for direct, ricochet, or curved fire; there should be a number of extra barrels of powder provided, above that which may have been calculated as adequate to the quantity of projectiles required, in order to allow of increase in the charges for the different natures of ordnance. Ten per cent. spare fuzes, and 20 per cent. spare tubes are allowed.

For what purposes is Artillery employed in sieges?

Object of
Artillery.

(1.) To keep down fire of besieged and protect works of besieger.

(2.) To defend batteries and parallels against sorties, &c.

(3.) To drive from their lodgments any troops harassing working parties and guards of trenches.

(4.) To ruin defences of besieged and prevent his repairing damages.

- (5.) To destroy enemy's stores and magazines.
- (6.) To form breaches to admit assaulting columns.
- (7.) To cover and support movements of assaulting columns on day of attack.

Thickness of Parapets, &c. *What should be thickness of the parapets of the besiegers' batteries and distance between guns?*

Parapets should be at least twenty-five to thirty feet thick and guns should be thirty-six feet apart.

Screen. *What would be the advantages of a screen or blind thrown up in front of battery?*

- (1.) To conceal the battery during construction.
- (2.) To cause enemy's shell to burst short of battery.
- (3.) Deceiving enemy's Artillery as to distance, causing their guns to be incorrectly laid.

When should the arming of siege batteries, erection of gyny, &c., take place?

During night as far as possible.

Captured Artillery. *On the fall of a fortress what is done with the captured ordnance and Artillery?*

It is handed over to the C.R.A. who takes an inventory of it, and then hands it over to the charge of the Store Department.

Number of Men. *What regulates number of men for a siege equipment?*

Sufficient to allow of three full reliefs, exclusive of magazine and store duties, and a reserve to replace casualties. The proportions for three reliefs would be 30 men per gun, 15 per large mortar, 9 per small mortar.

Depôts and Parks. *At commencement of investment of a fortress how is the material required for the siege train collected together?*

In Artillery depôts, and parks or field arsenals.

Who are in charge of these and how is the supply of stores kept up? Charge of Depôts, &c.

The Store Department have charge of both the depôts and parks; the supply of stores, &c., in the parks or field arsenals being kept up from the depôts. The batteries receive their armament and other stores from the field arsenal.

How does the O.C.R.A. obtain stores from the field arsenal? Officer commanding R.

By demands having the covering authority of the Adjutant-General of the army.

Who is responsible that a proper supply of guns, ammunition and stores is ready at a siege, and when does the officer commanding R.A. become accountable for them? Supply of Ordnance, &c.

Whenever the formation of a siege train may be necessary the description of guns will be fixed by the Secretary of State for War, in communication with the Commander-in-Chief. The Adjutant-General will, with the approval of the latter, prepare for the consideration of the Secretary of State, a detailed statement of ammunition and stores, and also a second detailed statement to replace the expenditure of the first.

The whole will be in charge of the principal Superintendent of Stores. On arrival at the port of disembarkation the whole or such portion as may be determined by the Commander-in-Chief, will be landed. The O.C.R.A. will specifically detail the guns, ammunition, and stores required, these will be moved to the field arsenal, where he will take them over, remove them to the trenches and become accountable for them.

The O.C.R.A., under the orders of the general in command, will specify the reserves he requires and it will be the duty of the Superintendent of Stores to keep them

Duties of
O.C.R.A.
(continued).

up and to lay down intermediate reserves between the field arsenal and the dépôt.

The O.C.R.A. will visit the field arsenal from time to time with the Superintendent to satisfy himself that the proper proportions and descriptions of stores are kept up.

Sights.
For S.B.L.S
Guns.

See **Defence.**

What sights are there for S.B.L.S. guns?

Millar's sights, consisting of a *hind sight* at the breech, and a *dispart* or *fore sight* in front of the second reinforce, the height of latter being equal to the dispart at that part of the piece.

Describe tangent scale of hind sight?

The tangent scale of hind sight is made of brass and fitted into a block of gun-metal which is screwed on behind the base ring; this scale gives elevation up to *clearance angle*, is graduated to short radius, and the second point of sight is the dispart sight.

Wooden Tan-
gent Scales.

What other tangent scales are there?

There are two wooden tangent scales. No. 1 is issued with Millar's sights and is used for elevations exceeding the clearance angle of the gun. It is graduated to 8° , and those divisions above the clearance angle are graduated to the long radius, the notch on the muzzle being used as the second sight.

No. 2 tangent scale of wood, is intended for those guns not provided with Millar's sights and which have no dispart sight, they can be used only for elevations above the *line of metal elevation*.

Quarter
Sights.

What are the quarter sights?

The elevation as far as 3° , (termed quarter sights,) is cut on the sides of the base ring in bronze field guns, and in

the 32-pr. and lower natures of cast-iron guns, beginning from a notch, which, with another cut in the side of the swell of the muzzle, gives a line of sight parallel to the axis, but a little above it, so as to clear the capsquare of the trunnions.

What sights are used in the Naval service? Describe them. Sights used Navy.

Brass tangent scales of hexagonal form : on the different faces, except one which has degrees marked on it, are the ranges in yards, corresponding to different charges and projectiles, thus :—

° For degrees.

F.	...	yds. Full	} Charges for Shot.
D.	...	yds. Distant	
R.	...	yds. Reduced	
SF.	...	yds. Full	} Charges for Shell.
SR.	...	yds. Reduced	

High elevations are given by long brass tangent scales of similar forms.

A wooden tangent scale, called the *side tangent*, is used in the Navy, and is held (to give elevation) on one of the steps of the gun-carriage ; it gives 12° elevation and 6° depression.

How are the 150-pr. and 100-pr. B.U. guns sighted? For 150-pr and 100-pr

They have a barrel-headed and trunnion sight on each side of gun, same as in 7" B.L. gun. The tangent scale is vertical, there being no derivation with S.B.O. B.U.S.B. Guns.

How is the derivation allowed for in sighting Armstrong guns? Armstrong Guns.

The tangent scale is inclined to the left at an angle of 2° 16'.

What sights are provided for Armstrong B.L. guns? Armstrong B.L. Guns

or Arm-
strong Guns
continued).

A *barrel-headed* and a *trunnion* sight on each side of piece; the former is held in a *tangent ring* or in a *socket*, according to nature of gun.

tangent Ring. Describe the *tangent ring*; with what guns is it used?

It is used with all B.L. guns, except 7" (screw), 64 and 40-prs. (wedge). It is made of wrought-iron, and is screwed on to the end of breech. On each side of it is a socket having a slot for the tangent scale, and a boss projects beyond the socket, through which a screw passes to clamp the tangent scale. The tangent ring is adjusted so that both slots are inclined to the left, at an angle of $2^{\circ} 16'$.

sockets. What guns have sockets? Describe them.

The 7" (screw), 64 and 40-prs. (wedge) have sockets. Each contains a slot for tangent scale, fits into side of breech, and is prevented from turning by a projection which dovetails into the metal of the gun; the sight is provided with separate movable clamps. The slot is inclined to left, at an angle of $2^{\circ} 16'$. The socket is kept down in its place by a small screw which passes through it into metal of gun.

barrel-headed sight. Describe *barrel-headed sight*.

It consists of a *bar*, *elevating nut*, *cross-head*, two *thumb-screws* for moving leaf, and *leaf*. The whole of gun-metal, except the bar which is of steel in all guns except 12-pr., and 7-in. of 72 cwt. One side of bar is graduated in degrees, and the other in yards. The degrees are divided into six parts of $10'$ each, and any number of minutes up to $10'$ each can be given by turning round a graduated elevating nut on the top of the bar, which works an internal screw, and raises the head of the scale. The cross-head is horizontal and is graduated to give $\frac{1}{2}^{\circ}$ of deflection either to right or left, and this $\frac{1}{2}^{\circ}$ is divided into three parts of $10'$ each on both sides; at each end of this slide is a graduated nut divided into minutes up to $10'$,

and these nuts are connected by a screw crossing the bar at right angles. A leaf with the sight notch slides along the scale and can be moved either right or left by either nut.

Describe the trunnion sights.

Trunnion
Sight.

There are two kinds, viz., *drop sights* and *screwed-in sights*. The light 7", 12-pr., 9-pr., and 6-pr. are supplied with latter, and other natures with former. The *drop sight* consists of a gun-metal *socket*, *collar*, and *pillar*, and a *steel leaf*. The socket fits into gun, the collar locks into the socket, and the pillar, at the top of which the leaf is screwed, fits into the collar. The *screwed-in sight* is made of steel, and has a steel leaf dove-tailed into its top and screwed into a hole above the trunnion. The leaf is hog-backed in shape, and its rear surface roughened to prevent the reflection of the light interfering with laying the gun.

What additional sights has 64-pr. wedge gun?

64-pr. Wedge
Gun.

An *hexagonal brass sight* (tangent scale) graduated to 5°, and a *dispart* or *fore* (drop) sight; the former on top of breech, the latter on top of trunnion ring.

What sights are M.L.R. guns provided with?

With a breech tangent, and trunnion fore (drop) sight M.L.R. Gun on each side of the gun, and also with an hexagonal tangent scale graduated to 5°, and a *dispart* or *fore* (drop) sight on top of piece; the breech tangent sights fit into sockets let into the side of the breech, and are inclined to left like those of a B.L. gun, but at different angles, the inclination of sight for 7-in. gun being 3°, for 8-in. 23', for 9-in. 44', and for 10-in. 1° 10'. Heavy.
Inclination
Sight.

What sight has taken the place of the barrel-headed sight?

The L.S. and S.S. tangent sights. No more barrel-headed sights are to be manufactured.

Describe L.S. tangent sight.

L.S. Tangent Sight. It is of simple construction, has same steel bar as barrel-headed sight; it is graduated in same way, inclined at same angle, and provided with the graduated elevating nut, but instead of the barrel-head it has a simple cross-head with sliding leaf and clamping screw, which is used to move the leaf to right or left. The cross-head is graduated like that of the barrel-head to give $\frac{1}{4}^{\circ}$ on each side, each $\frac{1}{4}^{\circ}$ being divided into three spaces of $10'$.

S.S. Tangent Sight. *How does S.S. tangent sight differ from above?*
It has no elevating nut.

64-pr. and 80-pr. Converted Guns. *What sights have 64-pr. and 80-pr. Palliser converted M.L.R. guns?*

Each is provided with a breech and trunnion sight on each side of gun; no top sights. A wood side scale is also supplied.

40-pr. and 25-pr. *How are 40-pr. and 25-pr. M.L.R. guns sighted?*
They are side-sighted, having two tangent sights and screw trunnion sights of the usual pattern.

16-pr. *How is the 16-pr. M.L.R. gun sighted?*
It is side-sighted, having two tangent sights set at $1^{\circ} 50'$ to the left, and two steel trunnion sights screwed in. The tangent sights have rectangular steel bars with gun-metal sliding leaf heads, and are graduated with degree, yard, and fuze scales. On account of the short radius of sighting, the slow-motion elevating nut is retained to ensure accuracy of aim.

12-pr. M.L.R. *How is this gun sighted?*
Centrally. The tangent scale is inclined at $1^{\circ} 30'$, and

is graduated to 6° and 12°, each degree being sub-divided into 20 divisions of 3' each. There is a deflection scale on it graduated to 30'. The fore-sight is a small hog-backed sight screwed into a recess on the dispart patch. In future issues the tangent scale will be graduated in hundreds of yards upon the right flat side, and with corresponding lengths of fuze on left flat side.

How is this gun sighted ?

7-pr. Steel
Gun.

Centrally. The tangent scale is inclined at 3°, has a plain head and no deflection scale, it is graduated up to 12° ; for higher elevations a wood scale graduated to 20° is supplied.

Of what is slow-match made ?

Slow mat

Of pure hemp slightly twisted and boiled in a ley of water and wood ashes, in the proportion of—water, 50 gallons ; wood ashes, one bushel ; this serves for 100 lbs. of yarn.

At what rate does it burn, and for what is it used ?

At the rate of one yard in eight hours ; it is used for lighting portfires, &c.

How would you ask for slow-match ?

By the weight ; about 4 yards goes to 1 lb.

What is the length, weight, &c., of Snider cartridges ?

Small-ar.
ammuni-
tion.
Snider Ca-
tridge.

Length of cartridge a little over $2\frac{1}{2}$ " ; weight of packet of ten rounds is 1 lb. ; charge is 70 grains of R.F.G.

Describe Snider bullet.

Bullet.

Bullet is of pure lead ; weight 480 grains ; head is hollow and closed by lead being spun over it ; hollow in base filled with plug of clay soaked in beeswax ; the bullet has three cannelures round it holding lubricant.

Hollows in
Bullet.

What is the object of the hollows in head and base?

The hollow in the head is to get bullet of sufficient length for good shooting without increasing the weight, and to get C. of G. in proper place.

The hollow in the base is to give expansive action to the bullets.

Martini-
Henry Am-
munition.
Bullet.

Describe the ammunition for the Martini-Henry rifle.

The bullet is made of lead hardened with tin, 1·27" long, weight 480 grains; its diameter increases from ·439" at shoulder to ·45" at base. Small hollow in base of bullet tends to expand it, and great length causes it to set up in the bore and fill the grooves, the cannelures allow the cartridge to be secured to the bullet by choking.

Charge.

The charge is 85 grains R.F.G.².

The cartridge is of bottle-neck shape to make it fit into short chamber of rifle. The case consists of two turns and an overlap of ·5" of ·004" brass, and in addition to two base cups, has a strip of brass ·005" thick between folds of case at base of cartridge. The bullet has two turns of fine white parchment paper wrapped round it from right to left and lubricated at the base for about half its length in bees-wax. The object of the paper is to prevent leading, and it untwists in passing through bore. Over the powder in the cartridge is a cardboard disc, then a wad of bees-wax, then two more cardboard discs. The cartridge is a little over 3" in length.

Packing.

How is it packed?

In tens, heads and tails in brown paper. Weight of 10 rounds a little over 1 lb.

Advantages.

What are the advantages of the Martini-Henry over Snider rifle?

It has a flatter trajectory, greater accuracy and penetration and can be loaded more rapidly. The bullet is less deflected by wind.

How are S.A. cartridges stored and carried?

Cartridge
Barrels.

In S.A. cartridge Barrels or Boxes.

The barrels are of 3 sizes, half, quarter and eighth; they have no copper hoops. The half size is used for blank cartridges, 2000 rounds; the quarter size for ball, 700 rounds, and the eighth for small supplies. For ball cartridges, they are being superseded by boxes; they have sliding lids, are made of teak or mahogany lined with tin; they hold 600 rounds of Martini-Henry cartridges and weigh about 78 lbs., packed.

See **Carriages, Pack animals, and Reserves.**

Mode of
Carrying.

Into what classes may S.B. ordnance be divided and what are the functions of each?

Smooth-
bore guns
Classes.

Into Guns, Mortars, Howitzers, and Carronades.

(1.) Guns are used for projecting shot and shell, horizontally or at very low angles with fixed charge.

(2.) Mortars are short pieces of ordnance, used to throw shells at high angles generally 45°, the charge varying with range required. See **Mortars.**

(3.) Howitzers resemble guns in form, but are much shorter and lighter in proportion to their calibre, and are fired with less charges of powder; shell and case are fired from them but not solid shot.

(4.) Carronades may be considered obsolete. They are short pieces of ordnance of cast-iron, with less thickness of metal than guns of same calibre. They project shot of large calibre with accuracy at from 400 to 600 yards with great saving of metal, powder, and gun detachment

See **Appendix.**

What kinds of S.B. guns are there and how distinguished?

Guns.

Two kinds—viz., *shot* guns and *shell* guns. The former project both shot and shell and are distinguished by the weight of the solid cast-iron shot and the weight of the

SMOOTH-BORE GUNS

See the appendix—the 7th. cannon gun of 95

[illegible]

U.S. - 2010 Census Bureau of Economic Analysis

Accounting rate: $\Delta \text{price} = 20 \text{ units} \times (\text{cost} - \text{price}) = 20 \times (\text{cost} - \text{price})$

[illegible]

مجلسه ۱۱۱ - ۱۳۸۸

[illegible][illegible]

一、政治思想：热爱祖国，热爱社会主义，热爱共产党，热爱集体，热爱劳动，热爱科学，热爱人民，热爱和平，热爱生命，热爱自然，热爱一切美好的事物。

[Illegible handwritten notes]

~~SECRET~~ ~~TOP SECRET~~ ~~CONFIDENTIAL~~ ~~SECRET~~

1. 凡在本行开立存款账户的客户，均可向本行申请开立支票。
 2. 支票的有效期为自签发之日起 10 个工作日内。
 3. 支票的金额不得超过账户余额。
 4. 支票的签发人必须是账户持有人或其授权代理人。
 5. 支票的收款人必须是本行客户。
 6. 支票的用途必须合法。
 7. 支票的签发必须符合相关法律法规的要求。
 8. 支票的签发必须符合本行内部风险控制的要求。
 9. 支票的签发必须符合本行对客户身份识别的要求。
 10. 支票的签发必须符合本行对客户交易背景的要求。

What are the disadvantages of howitzers ?

Their recoil is very great, and consequently the destructive effects upon the carriage are great. Also the ranges obtained are short.

What is the peculiar construction of Carronades ?

Carronades

They have no trunnions, and are cast with a loop underneath, a bolt passing through which attaches them to their carriages. They have no swell at the muzzle, but an enlargement of the bore, or cup, to facilitate loading and save the rigging and hammock nettings on board ship.

How are they sighted ?

They have a sight on the reinforce ring.

What is the proportion of charge to weight of shot ?

One twelfth.

What is the meaning of the term "Softness" as applied to a metal ?

Softness.

A metal is said to be *soft* when it yields easily to compression without breaking, and does not return to its original form on the removal of the compressing force.

What are the regulations as to the amount of solitary confinement a Court Martial may award a prisoner ?

Solitary confinement.

A General, District or Garrison Court Martial may sentence any soldier to imprisonment with or without hard labour, and may also direct that such offender shall be kept in solitary confinement for any portion or portions of such imprisonment not exceeding 14 days at a time, nor 84 days in any one period of 336 days, with intervals between the periods of solitary confinement of not less duration than such periods ;—and when imprisonment awarded exceeds 84 days, the Court shall expressly order that the solitary confinement shall not exceed 7 days in

any 28 days of the whole imprisonment awarded, with intervals between the periods of solitary confinement of not less duration than such periods.

336 Days
Impt. H.L.
and S.C.

Write out a sentence of 336 days' imprisonment with hard labour with the maximum amount of solitary confinement that can be awarded?

"To be imprisoned for three hundred and thirty-six days, eighty-four of the said three hundred and thirty-six days to be solitary confinement, such solitary confinement not to exceed seven days in any twenty-eight days, with intervals between the periods of solitary confinement of not less duration than such periods, the remainder of the imprisonment to be with hard labour."

Star shell.

With what guns is the star shell used, and what gauge and fuze does it take?

With 7-pr. mountain guns. G.S. gauge—takes 5" M.L. fuze.

Describe the star shell.

It consists of a thin cylindrical iron shell having a chamber in the base to take the bursting charge ($\frac{1}{2}$ dram of R.F.G. powder in a red shalloon bag); over the bursting charge is a wrought-iron disc with a hole in the centre. The interior is filled with 13 stars. The stars are paper cylinders filled with a composition which burns about 18 seconds and gives a brilliant light. The top of shell is made of wood covered with tin and is lightly attached to the body by rivets, it contains a gun-metal socket to take fuze, having a fire hole at bottom. Quick match is wrapped round the stars to ignite them and convey flash of fuze to burster. A kit-plaster is placed over head, this must be removed to prepare the shell, the plug unscrewed and fuze fixed. The shell has one row of studs.

What ranges have been obtained at different elevations with certain charges ? Range of Star-Shell.

Elevation 15°. Charge 4 oz. Range 600 yards.
 „ 27°. „ 1 oz. „ 400 „

What is the latest definition of steel ?

Steel.

Any alloy or variety of Iron, cast when in a melted state, into a malleable ingot.

What is the essential difference between steel, wrought-iron, and cast-iron ? Amount of Carbon.

The proportion of carbon present in each. Wrought-iron has from 0·1 to 0·3 per cent., steel 0·3 to 2·0, and cast-iron 2·0 to 5·0.

How is steel treated in preparing it for the inner barrels of guns, and what are its merits and demerits as a material for ordnance ? Merits and Demerits.

It is toughened and hardened by heating it and plunging it in oil.

From its hardness, high tensile strength, and freedom from flaws and defects, it is well suited for the inner barrels of guns, but its brittleness, and uncertainty when subjected to sudden strains, render it unsuitable for the exterior portions. See **Iron**.

Enumerate the stoppages of pay to which a soldier R.A. is liable for his messing, &c. Stoppages of pay, &c.

1.—Daily stoppages when at duty.

At Duty.

(i.) For groceries, vegetables, &c., . . . 4½d.

(ii.) „ washing, ... 1d.

Total not to exceed 5½d.

2.—Daily stoppages when in hospital (food and wash-
 ing included).

In Hospital.

(i.) Receiving hospital diet, . . . Men. 7d. . Boys. 6d.

(ii.) „ medical comforts but
 no diet, . . . 6d. . 6d.

In Hospital
(continued).

Monthly.

For Necessaries, &c.

(iii.) In cases of illness from misconduct a man may be stopped his whole pay except 1d. a-day.

3.—Monthly for hair-cutting, 1d.

4.—(i.) To replace necessaries, &c., all his pay except 1d. a-day.

(ii.) When confined in Military or Provost Prison or in Garrison Cells, 1½d. a-day for 28 or less number of days is stopped, if supplied with prison clothing.

(iii.) Barrack damages—whole amount or share.

(iv.) Marking clothing and necessaries (except first issue) ½d. per article.

(v.) Spirit ration, 1d. a ration.

(vi.) Maintenance of wife and children; above rank of sergeant 6d., below, 3d. a-day.

(vii.) Fines for drunkenness. See **Fines**.

On board
Ship.

5.—On board ship 1½d. for groceries and 1d. for spirit ration or equivalent.

Forfeiture of
Pay.

Under what circumstances and to what extent does a soldier forfeit his pay?

Forfeiture implies the loss of the whole daily rate of pay, thus differing from stoppage, which means only a partial loss. A soldier forfeits his pay for each day :—

(1.)—When service towards limited engagement, or G.C. pay is not allowed to reckon.

(2.)—For absence without leave for any number of days not exceeding 5, when deprivation of pay is inflicted by C.O., or convicted of the offence by C.M.

Subsistence
Money.

What allowance is granted to soldiers who forfeit their pay by imprisonment in cells, or confinement in the guard-room?

An allowance of 2½d. a-day and free rations are borne by the public in the following cases, viz :

(1.) When a soldier is confined in cells,

(2.) When confined in the guard-room, waiting trial which results in conviction.

(3.) When sentenced by C.M. to imprisonment—for the days he is in guard-room before being sent to prison.

Does a soldier receive pay on the day of his release from prison?

No. He receives a ration or its money equivalent, and cannot be placed on duty that day.

What two principal strains is the metal of a gun subject to?

Strain on the metal of a Gun.

A transverse or tangential, and a longitudinal strain.

What portion of the gun receives the maximum pressure, and by what is that pressure influenced?

The portion of metal surrounding the space originally occupied by the cartridge; the maximum pressure is influenced by the nature of powder, resistance offered by the projectile to motion, and by the absence or amount of windage.

If a rifled and a S.B. piece be respectively fired with similar charges and projectiles, which will receive the greatest strain, and why?

In R. and S.B. Guns.

The rifled piece, because with it there is little or no windage and consequently little or no escape of gas; the projectile experiences great resistance in motion from the grooves and has a motion of rotation as well as of progression, and therefore the gas being more condensed, exerts a greater pressure on the gun.

How is the increase of strain allowed for in rifled guns?

By diminishing the charge, it being for rifled guns from $\frac{1}{10}$ to $\frac{1}{8}$ and in S.B. from $\frac{1}{4}$ to $\frac{1}{3}$ the weight of projectile. The strain is also reduced by substituting P. for R.L.G. powder with heavy charges.

Limit of
Thickness.

What is the limit beyond which it would be useless to increase the thickness of metal in a gun?

When the force exerted upon the surface of the bore would be sufficient to rupture the interior portions of the metal before the strain acted to any extent upon the exterior.

Strain on
B.U. Guns.

How is the equalization of the strain upon the metal of our service B.U. guns secured?

By shrinking on rings or tubes of wrought-iron or steel over a cylinder of cast or wrought-iron, or steel.

Effect of
Calibre.

What effect has the calibre of a gun on the strain exerted on it from the explosive effects of the charge, the densities of the shot being alike and the weights of charge bearing same proportion to those of the shot?

The larger the calibre, the greater the strain.

of Angle of
Elevation.

What effect has the angle of elevation with which a piece is fired upon the strain?

The strain increases with the angle of elevation.

of Position of
Vent.

How is the strain affected by the position of vent?

The nearer the vent is to the bottom of the bore, the less the strain is.

Strategy.

Define the meaning of the term "Strategy".

Strategy is the art of moving troops in a theatre of war so that, by the direction of their march, and apart from their powers of manœuvring and fighting, an advantage may be gained over the enemy.

Studs, ma-
terial for.

What metals are used for studs and why?

For all projectiles for 7" M.L.R. guns and upwards the studs are made of an alloy of 10 parts of copper to 1 part of tin, as it is necessary to use a soft material in order to

prevent the shell being split, in pressing the studs into the under-cut holes during manufacture.

For the 80-pr. projectiles, pure copper is used for the 80-pr. and same reason, and for the 64-pr. the studs are also of ^{64-pr.} copper, on account of a soft material being requisite to admit of ready compression by the shunt system of grooves which was originally employed with this gun.

For lower natures gun-metal is used, except for the 9-pr. ^{Lower} and 7-pr. projectiles whose studs are of zinc, as they were ^{Natures.} originally made for bronze ordnance of the same calibre. In future manufactures the zinc is to be replaced by copper.

What considerations regulate the number and position of studs on a projectile? ^{Number and position of Studs.}

Their number and position are so regulated that they may take the entire bearing on the grooves, and give the direction and twist to the projectile, without permitting the body of the latter to come into contact with the bore.

On which side of the studs of a service projectile which has been fired, would you look for the wearing action of the grooves? ^{Action of Grooves on Studs.}

On the left side, as that is the side which presses against the "driving" side of the groove.

See **Stoppages**, p. 226.

Subsistence money.

T.

Tackles. *What does a simple tackle consist of?*

Simple Tackle

Two or more blocks rove with a single rope or "fall". The fixed end is called the "standing end", and the other the "running end" of the fall.

Definitions. *Define the terms "a return" of the fall; to "overhaul" "round in" and "rack" a tackle.*

Each separate part of the fall contained between two blocks, or between either extremity and a block, is called "a return" of the fall.

To "overhaul" a tackle is to separate the blocks.

To "round in" a tackle is to bring the blocks closer together by hauling in the fall.

To "rack" a tackle is to fasten any two opposite parts or returns of a tackle together, so that the blocks may retain their relative position although the running end be let go.

What points should be attended to in the arrangement and use of tackles?

The condition of straps, blocks, and cordage; that the fall is free from kinks and turns, and fits grooves of the sheaves; that the returns and running end do not press against the shell; the nature of the fastenings should ensure perfect security; the proper stoppering of the fall, the stopper being stronger than the rope it has to hold; the fall when it is taut is not to be jarred by being struck or by men treading on it; the position of the men must be perfectly safe; the men must pull together silently.

What is a "leading block" ?

Leading B

It is a single block made fast to a point in the direction in which it is intended that the weight shall be hauled upon; the rope made fast to the weight is then passed round the sheave of the block, and the men can haul on it in any direction they please.

Name the tackles used in our service.

Service
Tackles.

(1.) *One fixed block*, which gives no mechanical advantage.

(2.) *One movable block*, which doubles the power.

(3.) *A luff tackle*, consisting of a double and single 8" block with a fall of $2\frac{1}{2}$ " rope, which, when the single block is movable, trebles the power; when the double, it increases the power fourfold.

(4.) *A gun tackle*, which consists of two double blocks; when the standing end of the fall is made fast to the movable block, the power is increased fivefold; when made fast to the other, fourfold.

(5.) *A heavy gun tackle or light gym tackle*, consists of a double and treble block, which increases the power five or six times, as used.

(6.) *A medium or heavy gym tackle* consists of two treble blocks, and a power of six or seven is gained.

(7.) *A whip upon whip* consists of two movable blocks, one of which is applied to, and acts upon the running end of the fall of the other. It increases the power fourfold.

(8.) *A runner tackle*. A tackle applied to the end of a rope passing through another block is called a runner tackle.

How do you find the result of the combined action in a combination of tackles, where one acts upon the running end of the other ? Combinat
of Tackles

Multiply together the values of the several simple tackles.

Tactics.

What is the definition of "Tactics"?

The art and science of disposing and manœuvring troops to the greatest advantage in the presence of an enemy.

This object may be obtained in the following ways:—

(1.) By the relation of the fronts of the hostile armies to each other before or during the action.

(2.) By taking advantage of the configuration of the ground.

(3.) By adapting the different arms to the configuration of the battle-field.

Tangent scale.

See **Sights.**

Teams.

What should regulate the arrangement of horses in a gun and wagon team?

The horses of a team should, as far as possible, be of the same kind of stride and action. The most compact and powerful horses should be put in the wheel, if they are lower at the shoulder than the rest of the team, so much the better. Their legs, especially those of the shaft horse, should be good. The lead horses should be the tallest in the team, and the centre horses should be lower than the lead, but higher than the wheel horses, so as to get the traces all in the same line as far as possible. The off horses throughout should be a shade taller than the riding horses.

Tempering. *What is meant by "Tempering" a metal?*

Tempering a metal is cooling it suddenly after it has been raised to a high temperature, thereby giving it great hardness.

Tenacity. *What is the meaning of "Tenacity" as applied to a metal?*

It is the property of resisting rupture by traction. It is proportionate to the weight which the wire or rod of a metal of a given area is capable of sustaining.

How would you frame a charge for theft?

Theft.

1st Charge—Disgraceful conduct in having at ———, on the ———, stolen the following property, belonging to ———, viz. (*here describe the articles and their value*). Form of Charge.

2nd Charge—Disgraceful conduct in having at ———, on the ———, feloniously received the following articles, the property of ———, knowing the same to have been stolen, viz. (*here describe the articles and their value*).

N.B.—On a soldier's first trial for theft it is usual to omit the words "disgraceful conduct".

What determines the thickness of metal in a gun?

Thickness of metal

The charge, weight, and form of projectile, material used, and method of construction.

What is, roughly speaking, the proportion of metal in B.L.R. and M.L.R. guns to 1 lb. of projectile?

Proportion B.L. and M.L.R. G.

In B.L.R. guns from $\frac{1}{2}$ to 1 cwt. of metal to 1 lb. of projectile. In the heavy M.L.R. guns, rather over 1 cwt. of metal to 1 lb. of projectile in the 7" guns, but the proportion decreases with the calibre, till, in the 12" it is only about $\frac{3}{4}$ cwt.

What are tin cups used for?

Tin cups

Tin cups are used for all B.L. guns to prevent any escape of gas at the bottom of the bore. They are placed behind the cartridge. They have a rim .32" deep, which is pressed back by the explosion of the powder against the sides of the bore, thus preventing the gas from getting behind them. They have a hole in the centre to allow the charge to be ignited, and vary in diameter with that of the bore. Those used with wedge guns have a slight slit across the central hole to enable them to be fastened to the stopper. Each is supposed to last 10 rounds with the screw, and 4 rounds with the wedge guns.

Tops. *What were tops introduced for? Describe them and their use.*

For S.S. For naval service, they save space in stowage, protect fuze, and facilitate loading. They are only used with the 100-pr. S.B. built-up gun. They are made of wood like the bottoms and are fastened to the shell by means of four inclined rivets.

Toughness. *Define "Toughness".*

Toughness denotes the property of resisting extension or fracture, by tearing or bending.

Traces. *What should regulate the length of traces for a gun or wagon team?*

The traces for lead and centre horses should be of sufficient length to enable the horses to gallop without risk of striking each other's feet. The length varies but should leave at least one yard from nose to croup.

For wheel horses they must be of sufficient length to allow of the horses being thrown right back in the breeching without their quarters running any risk of striking the splinter-bar; for this it is better to have 18 inches between the splinter-bar and horse's quarters when the horses are in the collar.

What is the best position of the traces in draught, and when the horse is standing at ease?

In draught they should be perpendicular to the collar; when horse stands at ease they are inclined to the horizon at an angle of about 15° ; when he leans forward to draw, the traces should then become nearly parallel to the road.

Inclination of Traces. *What should be the inclination of the traces to produce the best effect? Give formula.*

The tangent of the inclination of the traces should be

equal to the ratio of the traction to the load, or

$$\tan \alpha = \frac{T}{W} \text{ nearly}$$

What influences the force of traction which a horse of average strength is capable of exerting?

The rate or speed of travelling, the time for which the force must be exerted, and the nature of the ground passed over.

See **Carriages**, p. 23.

Angle of Traction.

Define "Trajectory".

Trajectory.

It is the curved line described by the centre of gravity of a projectile in passing from the gun to the object.

State the advantages of a low trajectory.

Advantages of Low Trajectory.

- (1.) Greater accuracy.
- (2.) Harder hitting, as the lowness of trajectory means greater velocity and consequently more energy in the projectile.
- (3.) Greater distance covered effectively by the projectile.

The traversing gear for heavy M.I.R. platforms is too complicated for explanation without the aid of diagrams. For full description, see "Treatise on Military Carriages," by Captain Kemmis, R.A.

Traversing gear.

Define "Treason".

Treason.

In law, Treason means a covert or open act of compassing or devising the death of the Sovereign.

It also includes numerous acts and circumstances which constructively and remotely, as well as immediately, affect the safety of the Sovereign's person.

For what object, and how are trunnions placed on different natures of ordnance?

Trunnions.

**Object and
Position of
Trunnions.**

Trunnions are placed on a gun so as to allow the requisite preponderance to the piece, but they are cast on to the breech of a mortar, this being a convenient position as regards the mounting of the mortar on its bed for firing at high angles. They have one common axis perpendicular to that of the piece. They are usually about one calibre in diameter and length.

In S. B. Guns. *Why in S.B. guns is the axis of the trunnions placed below that of the piece?*

For the purposes of strengthening them; the gun can be laid more readily by means of the quarter-sight; the recoil is lessened.

In R. Guns. *What is the position of the trunnions in the rifled guns now made?*

The axis of the trunnions passes through that of the piece.

Tubes.

What different kinds of tubes are there in the service?

- (1.) Dutch or paper. (2.) Copper friction.
(3.) Quill friction. (4.) Electric.

Of what does a tube consist?

Of a barrel of quill, paper, or metal, about 3" long, driven with mealed powder damped with methylated spirit; at top of barrel is a cup or head, construction and priming of which varies with nature of tube; barrels are .2" in diameter. A hollow is made down the centre of the composition, so that the whole length may be ignited at once.

**Dutch or
Paper Tube.**

Describe the Dutch or paper tube.

This tube is nearly obsolete. The barrel and cup are of paper; priming of cup is the same as the composition in tube and it is worked into the form of a cone, and afterwards dipped in dry mealed powder. The cap is of paper dipped in solution of nitre, and secured underneath the

cup with twine ; it need not be removed before firing. This tube would be used with portfires.

Describe copper friction tube, how many sizes are there, and for what ordnance ? Copper Friction Tube

Three sizes—viz., short, about 3" in length for guns in general ; a special one, about 2" long for 7-pr. ; and the long friction tube, about 5" long for 10" R.M.L. guns and upwards in the L.S. There is a special 5" tube with a wire attached to prevent it from flying, issued for all the Woolwich guns in the Navy when waterproof cartridges are used ; a small lanyard is hooked on to the wire and hitched on to the gun carriage.

The copper friction tube consists of barrel of copper, the top stopped with shellac putty, and bottom with a disc of varnished paper ; a hole is bored through near top of tube in the copper and a cylinder or "nib-piece" inserted containing a copper friction bar roughened and slightly turned up at one end, with a small patch of detonating composition placed above and below the bar ; the nib-piece is pinched down so as to press on the friction bar, the projecting part of which has an eye into which the hook of the lanyard fits.

On pulling the lanyard the friction bar is drawn out, Action. igniting composition and firing the tube.

Copper friction tubes are issued in tin cylinders, hermetically sealed, containing 25 each.

Describe quill friction tube, give sizes, &c.

They are made in two sizes—2 $\frac{3}{4}$ " and 4" long—and are used by the Navy. Barrel is of quill, otherwise they are similar to the copper friction tube with very little exception ; a little meal powder is added to the detonating composition which is put on one side only of the friction bar. To support the tube when fired, a leather loop is attached which fastens on to a crutch or pin screwed into

Quill Friction Tube.

Use of Short Tube.

the gun near the vent. The short tube is used for Naval S.B. and rifled guns, except when firing reduced charges of 8" R.M.L. guns and over, and using waterproof cartridges; it is also used for signal rocket gun and with life-buoy portfires.

Use of Long Tube.

The long tube is made by cementing two quills together and is used for firing reduced charges in R.M.L. guns of 8" calibre, and over, and also for 24-pr. Hale's war rocket for S.S.

Precautions.

What are the special instructions with reference to the keeping of friction tubes?

The boxes are "not be placed in the magazine on any pretence whatever". This is written on one side of the box.

Causes of Failure.

How may tubes fail, and how long will they keep?

- (1.) From friction bar breaking.
- (2.) From the detonating composition failing to ignite when the friction bar is drawn.
- (3.) From the mealed powder failing, when ignited, to fire the puff.

Friction tubes are best when new. Those that have been kept over 10 years should be regarded with suspicion.

Electric Tube. *Describe Abel's electric tube.*

The barrel is of quill driven as usual, the head is egg-shaped made of beech-wood, through which there is a hollow communicating with the quill. Two fine copper wires pass down through the head, covered with gutta-percha except very small pieces at the ends. These uncovered pieces are fixed at a distance of $\frac{1}{18}$ " from one another, and the space between them filled with an explosive composition; the other ends of the wire are bent back and brought in contact with the copper lining of two holes passing through the head of the tube.

When the wires of the battery are inserted in these Action. holes, the current passes through the wires and the composition between them, igniting the composition in its passaga. Any kind of electricity will ignite these tubes.

They are used for proof of guns, firing time-guns by Use. electricity, &c.

Define the term "Twist" as applied to rifled guns, and Twist. how is it measured?

The twist is the term used to express the inclination of the groove, and measured by the length or distance in which one complete turn is made.

How would you find the angle of twist of a gun, knowing Angle of the calibre and the length of twist? Twist.

If α be the angle of twist

d = calibre

l = length of twist

then $\tan \alpha = \frac{\pi d}{l}$.

What is the difference between an uniform and an in-Uniform at creasing twist, and what is the object of the latter? Increasing Twist.

With an uniform twist the angle of twist is the same throughout the length of the bore; with an increasing twist the angle increases from breech to muzzle.

The object of the latter twist is to impart a high angular velocity and reduce the strain at the end of the bore. The grooves of the heavy service rifled ordnance of 8 inches calibre and upwards have been given an increasing twist.

What circumstances influence the amount of twist to be Amount of Twist—circumstances which influence this.

(1.) Solid shot require a greater velocity of rotation and therefore a sharper twist than shell of the same weight, because in the latter the distribution of mass is nearer the

Amount of
Twist (*continued*).

circumference of the projectile and therefore the radius of gyration is increased.

(2.) With the same calibre, the sharpness of twist must increase with the length of the projectile, as in a long shot the resistance of the air has greater tendency to turn the shot over on its shorter axis, on account of the greater leverage with which it acts.

(3.) The less the density of material of the projectile the greater must be the twist, as a light projectile loses its velocity of rotation quicker than a heavy one.

(4.) The C. of G. of a projectile should be as near the centre of figure as possible, to ensure great steadiness of flight.

(5.) The greater the I.V., the greater the velocity of rotation required, as the resistance of the air will be greater.

(6.) The shape of head influences the amount of twist; with flat heads the resistance of the air acts at right angles to the flat head and exerts greater effect than with hemispherical or pointed heads.

Objection to
Sharp Twist.

What is the objection to a very sharp twist?

See **Rifling**, p. 200.

What is the chief point which regulates the amount of twist?

The obtaining of the maximum velocity that can be given without imposing an intolerable strain on the gun.

U.

What different ways are there of rendering guns un- **Unservice-**
serviceable ? **able.**

(1.) By spiking ; (2) by knocking off a trunnion ; (3) with B.L. guns by taking away the vent-pieces or wedges ; (4) by breaking the wheels of the carriages, or by setting fire to the latter. With brass ordnance, by firing shot into the bore from another piece, &c.

How would you render guns unserviceable for a short time ?

By using spring spikes, and by carrying away the side arms and elevating screws.

How would you unspike ordnance ?

Unspiking

If the gun has been spiked with a common steel spike, load with a charge of powder equal to half the weight of the shot ; lay a leader of quickmatch along the bore, and double shot the gun, introducing the shot very carefully. By affixing a piece of slow-match to the end of the quickmatch (which reaches to the muzzle), the gun may be easily and safely fired. Should the spike not be removed, repeat the operation.

When a gun cannot be unspiked, another vent should be drilled, about half an inch from the original one.

V.

Velocity.
Initial Velocity.

What is the Initial Velocity of a projectile and how measured?

It is the velocity of the projectile at the moment of leaving the bore of the gun. Velocities are measured by the number of feet the shot traverses in a second of time.

What circumstances affect the velocities of projectiles fired from any piece of ordnance?

The amount of charge, position of vent, weight of projectile, windage, length of bore, chambers, and diameter of cartridge.

What are those affecting the velocities of projectiles of rifled guns only?

The calibre, system of rifling, and twist of rifling.

Increase of Charge.

What effect upon the velocity of a shot has increase of charge?

The initial velocity increases with the increase of charge only to a certain point, which is peculiar to each gun, when it is greatest; and by further increasing the charge the velocity gradually diminishes till the bore is quite full of powder.

Length of Bore.

What effect has the length of bore upon the initial velocity?

The initial velocity increases with the length of bore up to a certain point—viz., when the retarding forces have become equal to the accelerating force of the gas. This point is never practically reached, as it would entail too great length and weight in the gun.

What influence on the initial velocity has the position of the vent, (1) when placed at end of bore and in axis of piece, (2) when placed at end of bore on top, (3) when placed over the front of charge, (4) when over middle of cartridge?

(1.) Charge will be rapidly ignited but combustion will be slow, therefore velocity would be great.

(2.) Ignition of charge will be less rapid than in case (1), therefore velocity will not be so high.

(3.) Ignition would have to proceed over some distance, as in previous cases, but the projectile would have moved further before whole charge was decomposed, and there would be a great waste of gas by windage. Velocity therefore would be less than in two previous cases.

(4.) Ignition can proceed in both directions, and combustion should be quicker, the velocity therefore would be increased.

What influence has the diameter of the cartridge on the initial velocity?

By slightly reducing the diameter of the cartridge the velocity is increased, but a further reduction might decrease the velocity.

State best form of chamber to produce greatest initial velocity.

A chamber which has a neck less in diameter than the chamber. For practical reasons, however, this cannot be adopted, and in guns with large charges, chambers generally are of little or no use as far as the initial velocity of the shot is concerned.

What effect has windage on initial velocity?

The loss of velocity by windage is proportional to the windage (in S.B. guns).

Velocities of the same shot fired with different charges *If a shot be fired with different charges what is the proportion of the respective velocities?*

The velocities generated by the action of different charges of powder, in the same gun, are nearly as the square roots of these charges. This is when the difference is not very considerable.

Two balls of different densities fired with same Charge. *If two balls of different densities be fired from same gun with same charge, what is proportion of their velocities?*

The velocities generated by the same charge of powder, from the same gun upon balls of different densities vary inversely as the square roots of the weights.

Two balls of different weights fired from same gun with different Charges. *What is proportion of velocities of two balls of different weight fired with different charges from same gun?*

The velocities will be nearly in the ratio of the square roots of the charges divided by the square roots of the weights of the balls.

Weight of gun, Use of Wads, Ramming. *What effect has weight of gun, use of wads, and different degrees of ramming on the initial velocity?*

None.

Effect of Calibre on I. V. in a Rifled Gun. *How is the initial velocity in a rifled gun affected by calibre?*

It varies with the calibre. As the diameter is lessened the projectile will have a lower I. V. with same charge, because the area of base upon which gas acts varies as the square of the diameter of the shot.

Angle of Twist. *What influence has the angle of twist on the initial velocity?*

This point is not finally determined but it would appear that the velocity would vary inversely as the angle of twist, provided that the shot is not delayed in being set in motion.

What difference in velocity is obtained by using uniform twists and increasing twists? Uniform Increase in Twist.

The uniform gives the highest, but the increasing the most regular, velocities.

If two elongated projectiles of the same weight, but of different diameter are propelled by the same charge from guns of the same length, which will have highest I. V.

The one with the larger diameter. See above—effect of calibre.

Define the "Final" or remaining velocity of a projectile. Final Velocity.
The velocity at the end of any given range.

Define "Terminal" velocity. Terminal Velocity

When a body falls through air, a limit to the velocity it acquires occurs when the resistance of the air has become equal to the accelerating force of gravity; the motion of the body will then be uniform, and is called its terminal velocity.

See **Rifling**, p. 199.

Velocity
Rotation

If two solid projectiles of the same weight and form are fired from the same M.L. gun with the same weight of powder, will there be any difference in their velocities if one is projected by a cartridge of the same diameter as the bore, and the other by one of less diameter, within certain limits, say an 8" gun with a 6½" cartridge? Will the effect be the same on the gun with both cartridges? It is presumed that the whole charge is consumed in the bore. Effect of Cartridge in diameter than bore

The smaller cartridge will communicate the greater velocity. In the case where the cartridge fills the bore the combustion must proceed gradually; with the other an air space is left all round, through which the gas travels and ignites the whole charge in less time. This only holds good to a certain extent of diminution of diameter,

by greater reduction the air space and length of cartridge both increase, giving more room for expansion of gas (thus decreasing tension), and necessitating longer time for complete combustion.

A reduction in diameter decreases injury to bore, for the gas presses equally on bore throughout length of cartridge.

When cartridge fills bore, the gas first generated presses only on a small portion of bore, and tends to enlarge it.

Vent.

What is the vent and what is its diameter?

The vent is a small channel, by means of which a piece of ordnance is fired, it is $\frac{2}{3}$ " diameter, and the tube $\frac{2}{10}$ ".

**Position of
Vent.**

How is the vent situated?

In S.B. guns it is slightly inclined to the rear, entering the bore very near the bottom.

In heavy M.L.R. guns, the vent is vertical, and so placed as to strike the cartridge at $\frac{4}{10}$ of its length from the bottom of the bore.

In M.L.R. guns under the 64-pr., it strikes the curve at the bottom of the bore.

See **Velocity (Initial)** for effect of position on *I. V.*

Why are the lighter M.L.R. guns vented in this manner?

To ensure the whole of the unconsumed portion of the cartridge being blown out, and for the purpose of firing very reduced charges in short cartridges.

Bouching.

How is S.B. ordnance bouched?

By screwing a conical piece of copper into the gun near the bottom of the bore, through which the vent is previously drilled.

How is M.L.R. ordnance bouched?

In the same manner as S.B., except that the copper is hardened and marked "H".

What is the object of bouching ordnance ?

To prevent deterioration of the vent, or to provide a new one where this has already occurred.

The vent-piece of a 7" B.L. gun sometimes sticks—why ? Vent-pi and how do you prevent it ?

The angle face should be flat and the "nose" should fit closely into its place, otherwise the tin cup will be forced between it and the barrel, and cause it to jam. The edge of the face must be hammered gently, and the "nose" angle faced. See **B.L.O.**

What are the chief causes of the inaccuracy of vertical fire ? **Vertical**

The shells have low velocities and long time of flight, and are consequently liable to much deviation, from wind and other causes ; the angles of descent are so great that unless the object be of some extent, an error of range in a few yards might render the shell useless. In vertical fire, as the object cannot be seen, it is difficult to lay the piece properly.

See **Fire.**

State briefly the regulations with reference to this portion of the Reserve Forces. **Volunte Artiller,**

The regulations under which they serve are the " Volunteer Acts " of 1863 and 1869, and subsequent special regulations.

Several small corps are generally united so as to form an " Administrative Brigade ". The whole force is directly under the control of the Secretary of State for War.

The men are divided into classes as "efficients" and "non-efficients". To become an efficient, the volunteer must have received a certificate, signed by the C.O. and adjutant of his battalion, as to the knowledge of his military duties ; and he must have attended 30 drills as a

recruit (12 annually), and been present at the inspection of his corps, or at two drills extra.

apitation
rant.

The Government grant is at the rate of 30s. per annum for each efficient. Officers who have received certificates, and sergeants who have passed a prescribed examination and obtained the necessary certificate from the adjutant, obtain each an additional grant of £2 10s. for the benefit of the corps. Government provides arms and accoutrements but not uniform. See **Courts Martial**.

W.

Describe the various wads used in the service and the Wads. object of each.

1. The *Grummet* wad consists of rope bent in a circle, and held in position by two cross pieces of rope. Used with S.B. ordnance fired under 3° of elevation, to keep the projectile in its place. They are used occasionally with rifled guns when firing at angles of depression.

2. *Junk* wads are made up of old junk beaten into a solid cylinder and woolded over. They were used with red-hot shot in S.B. guns, and are now used in connection with tampeons to close the muzzle of a gun when not in use.

3. *Coal dust* wads are used with the 8" M.L.R. gun to fill up the 5 lb. cartridge and make it the proper length. They are in a blue serge bag.

4. *Papier Maché* wads are used to fill the loading-holes of diaphragm Shrapnel shell, and the fuze-holes of common shell. They are used in the fuze-holes of Naval shells, when empty, to protect the plug from wet, and when filled, they are placed over the fuze to protect it. In the latter case the wad has a loop.

5. *Bolton's* wads are made of 75 per cent. of old rags and 25 per cent. of tarred rope, pulped and formed in a mould and coated with waterproof varnish; they are used to prevent scoring of the bore.

6. *Wedge* wads are used with Woolwich guns to prevent the projectile from moving forward when the guns are run up violently, and if they are depressed. They consist of two wooden wedges about 6½ inches long, the

base being $1\frac{1}{4}$ inch square, connected by a piece of curved cane about 6 inches long.

They are rammed home separately after the projectile.

Wagons.

See **Carriages.**

Warrant for clothing. *Name the articles of clothing with which a soldier of the R.A. is to be supplied on the 1st April.*

APRIL ISSUE OF CLOTHING.	HORSE BRIGADES.	FIELD AND GARRISON BRIGADES.	
		Mounted Men.	Dis- mounted Men.
Busby and Holland Bag, quadren- nially	1	1	1
Cap Lines, quadrennially . . .	1	—	—
Dress Jacket or Tunic, annually .	1	1	1
Trousers, annually	—	—	1
Do. biennially	1	1	1
Pantaloon, annually	1	1	—
Gloves „	1	1	—
Knee Boots, biennially	1	1	—
Ankle Boots, annually	—	—	1*
Do. biennially	—	—	1*
Wellington Boots, annually . . .	—	—	1*
Do. biennially	1	1	1
A Canvas Suit, biennially to Nos. 4.			
* Four pairs of boots in two years, viz. :—			
1st year, { One pair Wellingtons on 1st April.			
{ One pair ankle boots on 1st October.			
2nd year,—Two pairs ankle boots ; one pair, 1st April,			
one pair, 1st October.			

How is the clothing of the R.A. provided ?

Upon yearly demands in duplicate from D.A.G. to Secretary of State, and is to be accounted for yearly, as soon after 31st March as possible, in a general appropriation return.

What steps are taken when the clothing arrives ?

Board of
vey.

It is inspected by a Board of Survey, consisting of the 3 senior officers.

When the Board condemns any article, the convening officer will represent the matter to the senior officer at the station, who will refer it with his opinion to the D.A.G.

When the clothing is unpacked, the number of each bale and contents are to be noted, and quoted in detail when a report is made of excess or deficiency.

What is done with the sealed pattern ?

Scaled
Pattern.

It must not be unsealed and issued until a fresh one replaces it the following year.

What report is made by C.O. as to quality and wear ?

An annual report in duplicate to the D.A.G., stating his opinion of the quality of the clothing, and whether it has worn well. This is sent in duplicate at the end of the military year.

State in detail the issues of clothing to recruits of Field and Garrison artillery.

Issues to
Recruits.

If finally approved betwixt 1st April and 31st December, a mounted recruit receives—

Mounted
Men.

One new tunic,	}	To last to the commencement
One pair of pantaloons,		of the following military
One pair of gloves,		year.

One pair trousers,	}	To last to the commencement
One pair knee boots,		of the 2nd military year
		after enlistment.

One pair of ankle boots, to be kept up by the man.

If finally approved betwixt 1st January and 31st March :—

One pair pantaloons,	}	To last to the commencement
One pair gloves,		of the following military
		year.

issues to
recruits (*con-
nued*).

One pair cloth trousers, { To last to the commencement
of the 2nd military year
after enlistment.

One pair ankle boots, to be kept up by the man.

And such other articles of part-worn clothing as may be
in store, to be renewed on 1st April following.

DISMOUNTED MEN.

If finally approved betwixt 1st April and 31st December,

One tunic, { To last to the commencement
One pair ankle boots, { of the following military
One pair cloth trousers. } year.

One pair Wellington boots, { To last to commencement of
2nd military year.

One pair cloth trousers, { To last to commencement of
2nd military year.

One pair gloves, to be kept up by the man.

Betwixt 1st January and 31st March :—

One pair cloth trousers, { To last to commencement of
One pair ankle boots, { following military year.

One pair cloth trousers, { To last to commencement of
3rd military year.

One pair gloves, to be kept up by the man.

And such other articles of part-worn clothing as may be
in store, to be renewed on 1st April following.

When does the clothing become the property of the soldier?

After the next issue (head-dresses, leggings, greatcoats
and cloaks excepted).

Busbies and
part-worn
Clothing.

*What is done with busbies of discharged men, and part-
worn clothing?*

Busbies are to be returned into store complete.

Part-worn clothing is to be taken into the regimental
store if fit for issue to recruits. If not fit (which is settled
by a Board), it is sold by auction, and if unsaleable,
handed over to the nearest barrack master.

What is the rule with reference to the supply of clothing Deserters, &c to men rejoining from desertion?

Men who rejoin from desertion, or return from confinement, are to be supplied with part-worn clothing if possible, if not, they are to be dealt with as recruits.

Should they be absent when new articles become due, they are not to be supplied with new articles when they rejoin, but with part-worn, equal to those in wear by the other men, or compensation till 31st March. They have no title to clothing between date of rejoining and carrying out sentence of C.M.

State rule in cases of promotion or reduction.

N.C.O.s.

A man promoted N.C.O. will, when practicable, be supplied with the clothing of his predecessor; if not practicable, and promotion takes place before 1st October, he will receive new clothing; if after 1st October, he will retain his rank and file clothing and receive compensation.

When a sergeant is reduced, an exchange is to be made with his successor if possible; if not possible, he will return his clothing into store and be dealt with as a Recruit.

How is a man dealt with on discharge?

On Discharge

If his service ends in 1st quarter he receives no new clothing, but compensation for the quarter.

If discharged between 1st July and 31st December, he may take away 1 part-worn tunic, do. trousers, do. boots.

If discharged after 31st December, whatever would have become his property on 1st April.

Invalids and time-expired men may take a condemned greatcoat away with them.

How is the clothing accounted for?

In a return sent in annually to D.A.G., and in a quarterly quittance roll from officers commanding batteries, with the

receipt of every man for articles or compensation received.

N.B.—No claim for compensation for less than 15 days in a month will be admitted.

Leggings. *How long are leggings to last ; how is their loss or damage made good ?*

3 years ; if lost or rendered unserviceable in 1st year, the full value is to be made good ; and 1s. per annum from their value to be deducted for loss or damage after that period.

Cloaks. *How are cloaks valued, and what is their duration ?*

New Pattern. For R.A. mounted men—new without cape, £1 16s. 4d. ; worn-out, 6s. ; cape, 11s. 2d. ; worn-out, 2s. Dismounted men—new without cape, £1 1s. 5d. ; worn-out, 6s. ; cape, 11s. 3d. ; worn-out, 2s.

Old Pattern. Mounted—new without cape, £1 14s. 6d. ; worn-out, 6s. ; cape, 14s. 7d. ; worn-out, 2s.

Dismounted—greatcoat, with cape attached, new £1 13s. 11d., worn-out, 6s.

Duration, for mounted men 10 years ; for dismounted 4 years. A driver's cloak is entitled to a new back after 6 years.

List and Price of Necessaries. *Give a complete list of necessities supplied to a recruit R.A. and the price of each article, when issued on re-payment—*

Name of Necessary.		Mounted	Price of each.	Dismounted
Bags {	Brush	1	s. d. 0 9½	1
	Waterproof	1	3 11	1
	Hook for do.....	1	0 0½	1
	Stable.....	1	1 2½	—
Blacking, tin of.....		1	0 2	1
*Boots {	Ankle, pair of.....	—	11 8	1
	Stable, „	1	11 3	1
Braces, pair of		1	1 0½	1
Brass paste, tin of		1	0 2½	—

WARRANT (CLOTHING)

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Name of Necessary.		Mounted	Price of each.	Dis-mounted	List and F of Necess (continued)
			s. d.		
Brushes	Brass	1	0 9 $\frac{1}{4}$	1	
	Clothes	1	1 3	1	
	Hair	1	1 4	1	
	Shaving	1	0 4 $\frac{1}{2}$	1	
	Shoe { Blacking	1	0 5 $\frac{1}{4}$	1	
	Shoe { Hard	1	1 3	1	
	Polishing	1	1 0 $\frac{1}{2}$	1	
Button holder, brass		1	0 1 $\frac{1}{2}$	1	
Cap, forage		1	2 3	1	
Case, plume		1	0 2	1	
Comb		1	0 2 $\frac{1}{2}$	1	
Drawers, Cotton, pair of		2	3 9	—	
Fork		1	0 3	1	
Gloves, pair of		1	2 11	1	
Holdall		1	0 8	1	
Jacket, Undress		1	16 1	1	
Knapsack	{ without boards, slings, or straps	—	4 11	1	
	{ boards for, set of	—	0 2 $\frac{3}{4}$	1	
	{ slings for, pair of	—	1 1 $\frac{1}{2}$	1	
Knives	{ Clasp	1	0 8 $\frac{1}{2}$	1	
	{ Table	1	0 3 $\frac{1}{4}$	1	
Mess Tin	{ Tin	1	1 4	1	
	{ Cover for	—	0 5 $\frac{1}{2}$	1	
Numerals for Jacket, each figure		—	0 0 $\frac{1}{2}$	—	
Oil, Can of		1	0 4 $\frac{1}{2}$	1	
Razor, with Case		1	0 6 $\frac{1}{2}$	1	
Rubber, Horse		1	0 8 $\frac{1}{4}$	—	
Shirts	{ Cotton, white, or	3	2 5	3	
	{ Flannel, grey	2	5 9	2	
Soap, pieces of		1	0 0 $\frac{3}{4}$	1	
Socks, Worsted, pairs of		3	1 5	3	
Sponge, Pipe-clay		1	0 9	1	
Spurs, swan neck, pair		1	1 7 $\frac{1}{2}$	—	
Straps	{ Greatcoat, pair of	—	0 10 $\frac{1}{2}$	1	
	{ Mess Tin	1	+0 3 $\frac{1}{2}$	1	
Towels		2	0 8 $\frac{1}{2}$	2	
Trousers	{ Cloth*	—	14 3	—	
	{ Duck	1	4 11	—	
Valise		1	13 7	—	
„ Straps for, single		—	0 6	—	
Vest Flannel (issued with cotton shirts)		2	4 0	2	

* Issued on repayment. First issue to recruit, with clothing.

† For mounted men, 5 $\frac{1}{4}$ d.

**Requisition
for Necessaries.**

At what periods are requisitions for necessities sent in, and how are they accounted for?

Abroad, annual requisitions are sent in; at home, on 1st March and 1st September.

They are accounted for yearly in the *kit account* (31st March), showing the receipts and issues during the year, and accompanied by a report of a Board on the state of the articles in store, and by four quarterly statements showing the necessities issued on repayment, and the sums credited on the pay list.

**Prisoners'
Kit.**

In the case of a soldier sentenced to imprisonment what is done with his kit?

If imprisoned for one year, it is retained in store, when for more, it may be sold, and he will get similar articles on coming out, from the Qr.-Master's store.

To what extent can a man's pay be stopped for necessities?

So as to leave him a residue of 1d. a-day, after paying his messing and washing.

**Knapsacks
and Valises.**

In case of a man becoming non-effective within two years from receiving new valise or knapsack, what is done with it?

The article is valued by a Board and issued to a recruit, who will receive compensation for not getting a new one. If unfit for issue, it is sold with the rest of the man's effects.

What is done with valises and knapsacks of discharged men?

The men have the option of taking them with them.

Commutation.

What is the amount of commutation in lieu of free kit?
Mounted men, £4 4s. Dismounted, £3 3s.

**Warrant
Officers.**

By what Courts Martial may a warrant-officer be tried and to what punishment is he liable?

By *general, district, or garrison.*

Courts Ma-
tial on
Warrant
Officers.

Dismissal, suspension from his rank, pay and allowances for any stated period, to be reduced to the bottom or any other place in the list of his rank, or to an inferior class ; or, if originally enlisted as a soldier, and remaining such until appointed W.O., to be reduced to the rank of a private soldier, or to the rank he held on being appointed W.O.

What peculiarities are there in the constitution of a C.M. for the trial of warrant-officers ?

They may consist of *five* officers in certain foreign stations, but elsewhere must consist of *seven* ; not more than *two* to be taken from the regiment in which the W.O. is serving, and not more than *two* to be under rank of captain.

Describe Abel's water shell.

Water
shell.

A common shell filled with water, with a gun-metal cylinder screwed in, containing $\frac{1}{2}$ oz. of gun-cotton.

The action depends simply upon the transmission, through the very incompressible medium, water, of the force suddenly developed by detonation.

The gun-metal cylinder, or the base of the percussion fuze, contains a small quantity of fulminate of mercury. The cylinder and fuze are screwed into the shell, the detonation of the gun-cotton is effected by the fulminate on impact, and the force thus generated is transmitted through the water, causing the shell to burst and disperse laterally in many fragments. (*Experimental at present.*)

See **Breech-loading.**

Wedge

What is the height of wheels for artillery carriages ?

Wheels

For Field Artillery carriages, and for most siege

carriages, 5 feet. For carriages intended to move more slowly, such as sling wagons, from 7 to 11 feet.

See Carriages.

rack. *Define the term "track" of wheels, and state its amount.*

The track is the distance from outside of one wheel to outside of other; it is 5 ft. 2 in. for the wheels of field carriages.

Classes. *Into what classes are the service wheels divided?*

Siege, field, general service, and naval.

They are classed I, II, III., and *special*.

In the first, second, and third class, every wheel in the class has the same sized pipe-box, though in weight and diameter they may differ. The first-class pipe-box is larger than the second, and the second than the third.

There are two distinct patterns of wheels in the service. The older, with a wood nave, and the more modern, or *Madras* pattern, with a metal nave.

**Wooden
Wheel.**

Describe the ordinary wooden wheel.

The nave consists of a *stock* of elm, mortised for the spokes, and containing a conical cast-iron *pipe-box*, enlarged towards the middle to form a grease chamber, and having the bearing parts chilled to render them hard. The *spokes* are of oak, 12 in number. That part which enters the nave is termed the *foot*, and that which enters the fellow, the *tongue*.

The *felloes*, 6 in number, are of ash, the convex surface is termed the *sole*, the concave the *bogom*, the outer side the *face*, and the inner the *back*.

The *tire* is of wrought-iron $\frac{3}{8}$ " thick, shrunk on and secured by a bolt through each fellow.

The heavy field wheel differs only in being of slightly stronger make.

Describe the Madras pattern field wheel.

Madras
Wheel.

The *nave* is of metal, made in three parts, viz., the *pipe-box*, the *inner flange*, and the *outer flange*. The pipe-box is conical internally and enlarged towards the centre to form a grease chamber; externally its surface is that of two conical frustra of different slope standing base to base.

The *spokes* differ from those of the wood naved wheel in the shape of the feet, which are cut so as to form a perfect arch round and resting on the pipe-box.

The wheel is shod with a ring-tire $\frac{5}{8}$ " thick. The heavy Heavy. field wheel differs from the light in having a tire 3" instead of $2\frac{1}{2}$ " wide; the felloes are also $\frac{1}{4}$ " deeper.

The flanges of all artillery wheels are of gun-metal, those for engineer and transport service of wrought-iron.

See also **Axletrees, Carriages, &c.**

How is a metal nave repaired?

Repair of
Nave.

When damaged from grit getting in between it and the axletree, it will be observed by a grinding noise and heating of the nave. Remove the wheel, clean pipe-box and axletree, and file down any burrs, put on fresh grease and replace wheel.

How is a damaged spoke replaced?

Repair of
Spoke.

Remove inner flange and pipe-box, and cut spoke (if not already broken) near foot. Then remove upper part from felloe by knocking it out or cutting it off, and make a fresh hole about 1" deep for tongue of new spoke. Split off with a chisel half of the foot at back, but leave a part to retain feet of other spokes in position. Drive in new spoke with a short tongue cut on it, knocking from beneath its foot the part of old spoke when necessary. Finally, cut off any part of foot projecting inside circle of other feet, paint foot and replace parts of nave.

What is windage?

Windage

The difference between the diameter of the bore and that of the projectile.

Disadvantages *What are the disadvantages of windage, (1) in a S.B. gun, (2) in a R. gun?*

(1.)—(i.) The loss of a certain portion of the force of the charge.

(ii.) Irregularity in the flight of the projectile.

(iii.) Injury to the bore of the gun by the rebounding of the projectile.

(2.)—(i.) Injury to bore by rush of gas over the projectile, called *scoring*.

(ii.) Unsteadiness of the axis of the projectile unless means are taken to centre it.

Advantages. *What are the advantages of windage?*

1. It lessens the strain on the gun.

2. It admits of the use of a time fuze ignited by the flash of discharge.

Amount. *What is the amount of windage in service ordnance?*

·1 inch in S.B. guns; from ·125 to ·233 inch in cast-iron guns and howitzers; ·08 inch in heavy M.L.R. guns; ·16 inch in 13" and 10" mortars.

Necessary in S.B.O. *Why is windage necessary in S.B. guns?*

1. In consequence of the impossibility of casting shot and shell perfectly spherical.

2. To allow for increase in diameter of projectile from rust, or to admit of the use of hot shot.

Wood, for Carriages, &c. *Name the woods principally used for artillery manufactures, and give their characteristics.*

(1.) The chief British woods are—oak, elm, ash, and beech.

Oak. *Oak is the strongest, toughest, and most lasting, and hence is used where strength and durability are required,*

as in the spokes of a wheel. N.B.—It contains an acid which tends to corrode iron in contact with it.

Elm is a very cross-grained tough wood little liable to Elm splinter, and very durable under constant wet. Hence its use for naves of wheels and ends of ammunition boxes.

Ash, a tough wood, and very elastic, which renders it Ash well adapted for shafts, handspikes, felloes, &c. N.B.—It does not stand exposure well.

Beech is a hard strong wood, but will not stand ex-Beech. posure. Used for fuzes, &c.

(2.) The chief Foreign woods are—African oak, *sabicu*, teak, mahogany, and pine.

African oak, a very durable, hard, close-grained wood; African Oak stronger, heavier and darker than English oak.

Sabicu, an exceedingly hard, heavy, and durable wood, *Sabicu*. and hence it is used for surfaces on which there may be much rubbing, or where durability is an object, and weight not objectionable.

Teak possesses great strength, toughness, and durability, *Teak*. but splinters readily. It contains an oil which preserves iron-work. Used for work sent to foreign stations.

Mahogany is strong in all directions and preserves its *Mahogany*. shape well.

Pine is soft, light and elastic. Yellow pine is used for Pine. the interior fittings of wagons. Yellow *deal*, the produce of the spruce, is used for ammunition boxes and the boarding of wagons.

Larch is a strong, durable, but knotty timber, and is *Larch*. only used for "uphirs," ladders, &c.

VOCABULARY OF TECHNICAL TERMS.



- Abattis.** An obstacle employed in field fortification, consisting of trees, felled and fastened to the ground, with their branches shortened and sharpened.
- Adze.** A copper-headed hammer used for knocking the hoops off powder barrels in magazines.
- Ambulance.** This term is applied to services connected with the conveyance of the sick and wounded.
- Army Corps.** A grand division of an army, consisting of 3 divisions of infantry, 1 brigade of cavalry, and 5 batteries of artillery (exclusive of cavalry and artillery attached to divisions), &c.
- Apron.** A square leaden plate to cover the vent of ordnance. Used generally when guns are kept loaded, to protect the charge from the effects of the weather.
- Basils.** Leather prepared from sheep skins strained.
- Bât animals.** Animals used for purposes of transport, such as the mule, camel, or elephant.
- Bearer.** For carrying the projectiles of the 7" B.L. gun. Made of iron, with three handles covered with leather. Bearers are also used with the heavy M.L.R. projectiles.
- Berm.** A space or path left between the exterior slope of the rampart and the ditch. It serves as a communication round the works, and prevents the earth falling into the ditch.
- Bevel.** The sloping part at the thick end of a handspike.

The noose or double part of a rope when folded. **Bight.**

Charges used for shells at practice when it is not desired to burst the shell. For mortar shells they are made up in red shalloon bags, narrow at the mouth, and with a brass ring to prevent the bag falling in. For rifled ordnance, the shell is filled with coal dust, leaving a space for the charge which is introduced in a calico bag with a neck to fit the fuze hole. **Blowing charges.**

A parapet or epaulment thrown up to afford cover to **Breast-troops.**

A brigade of cavalry consists of 3 regiments and 1 **Brigade.** battery of horse artillery.

A brigade of infantry, of 3 battalions.

Making a taper hole or perfecting a cylindrical one. **Broaching.** This process is employed in the construction of ordnance, to make inner barrel truly cylindrical after boring.

Gang-boards for embarking horses, with planked sides **Broughs.** 3 feet high.

A hollow metal cylinder inserted into the vent-piece of **Bush.** a gun, the fuze-hole of a shell, &c.

The projecting knob behind the breech of a gun ; it has **Button.** generally a cylindrical hole through it called the *breeching loop.*

A cacolet consists of a light iron-framed seat, attached **Cacolets.** to a pack saddle by hanging bars. For the conveyance of sick or wounded men.

Made of brass, for raising zinc cylinders containing **Cage.** cartridges, when being hoisted up powder-lifts of magazines.

Compasses with arched legs for measuring the diameters **Callipers.** of ordnance, shot, shells, &c.

To turn upside down. **Cant.**

The part of a piece of ordnance behind the breech. **Cascable.**

- Chase.** The part of a piece of ordnance which extends from a little in front of the trunnions (the end of the 2nd reinforce) to the beginning of the muzzle.
- Chevaux-de-frise.** Pieces of timber from 9 to 12 feet long, and about 6 inches in diameter, into which staves are inserted cross-ways, about 9 inches asunder, pointed at the ends, or shod with iron. Sometimes made entirely of iron. Used to stop a breach, defend a passage or to form an entrenchment against cavalry.
- Cleat.** A piece of wood with one or two arms, to which a rope is made fast.
- Clinching.** A method of fastening large ropes by a knot and seizings, and is used for the breeching of guns, attaching the standing end of the fall to the block in tackles, &c.
- Core.** The mould or former upon which a piece of ordnance or shell is cast.
- Couples, trace.** Small pieces of round iron with an eye formed in each end, bent into the shape of a link, with the ends about $\frac{1}{4}$ " apart. Used temporarily to replace a broken link; the links adjoining the broken one being hooked upon the couple, and prevented from coming off by a tie through the eyes of the latter.
- Cross-lift.** To move a gun, mortar carriage, &c., to the right or left, perpendicular to the axis.
- Crows-feet.** Four iron spikes joined together so as always to present one point to advancing cavalry. Used as an obstacle in the field.
- Deploy.** To unfold companies from column into line.
- Derrick.** Used for lighter weights than Sheers and also to raise Sheers themselves. A derrick consists of one spar, with shoe for foot, and 4 guy ropes to support it.
- Division.** An army corps is divided into 3 divisions, each consisting of 7 battalions of Infantry, one regiment of Cavalry, one 9-pr. field battery and two 16-pr. field batteries.

Handles formerly used with S.B. ordnance, placed near **Dolphins**, the centre of gravity to raise and lower the piece.

An unarmed artillery soldier who rides on the near horse, **Driver**, and drives a pair in a gun or wagon team.

The edge of the groove against which the studs of a shell **Driving edge**, bear, when fired from a piece of ordnance.

A mixture of oil and tallow applied periodically to **Dubbing**, leather work to preserve it.

Projectiles whose C. of G. does not coincide with their **Eccentric geometrical centre**, projectiles.

Shot with a head in the form of an *ellipse* are so called. **Elliptical headed**. An ellipse being the section of a cone, not parallel to the base.

An opening cut through a parapet, &c., for a gun to **Embrasure**, fire through.

A bank of earth thrown up to cover troops from the fire **Epaulment**, of an enemy. The epaulments shelter the flanks of a battery, and being usually struck obliquely by the enemy's fire, they do not require the same thickness as the parapet.

The side of a ditch next the rampart of a work. **Escarp**.

The open space between the citadel of a fortress and the **Esplanade**, town.

Small magazines where a supply of ammunition is kept **Expense magazines**, for the immediate service of ordnance in batteries.

The extractor for drawing out the tin-cup from a B.L. **Extractors**, gun is an iron lever with a barbed hook at one end and a curved hammer at the other, used as a "lever-lifting joint". This is the S.S. pattern, but is now issued for L.S., instead of the iron hook with wooden cross handle.

There are also *fuze extractors*, and instruments for extracting projectiles from M.L.R. guns.

A sort of eye or circle on a rope, formed by untwisting **Eye-splice**.

and doubling back the end, and splicing it into that part of the rope where it is desired to make the splice.

Fake.

One turn of a rope when coiled or stowed.

Fall of a tackle.

A rope rove through one or more blocks.

Fascines.

A superior kind of fagot; 18 ft. long, 9 in. in diameter; ends sawn even. Used for revetting the interior slopes of field works and the cheeks of embrasures.

Fid.

A wooden tapering pin with which ropes are spliced.

A short cylinder of wood inserted at the muzzle of a gun for mounting or dismounting purposes.

Flanders kettle.

A cooking kettle of cylindrical form; 4 per sub-division are carried with a Field Battery under the limbers and wagon, and 2 under the forge wagon.

Fougasses.

Charges of gunpowder buried in the ground and covered with stones or shells. Used to defend dead ground in ditches or breaches.

Fraises.

A kind of palisades, placed horizontally or obliquely in the exterior slopes of ramparts.

Frap.

To take several turns round the middle of a lashing or any number of ropes, and draw the several parts tight together.

Fulcrum.

A prop or support upon which a lever or handspike is supported when applied to raise any weight.

Futchells.

Bars of wood or iron, used in the framework of limbers; they are bolted to the axletree bed and splinter bar, and the platform-board and foot-board are bolted to them.

Gabions.

Cylindrical baskets open at both ends, made of wicker or sheet-iron. Used torevet the interior slopes of field works and the cheeks of embrasures.

Gas checks.

Wads or other means to stop the destructive escape of gas over the M.L.R. projectiles, and prevent injury to the bore from scoring.

Four lengths of angle-iron or wood, connected by pins in **Garlands**, the form of a square or rectangle. Used for the bottom tier of a pile of shot.

Flat-plaited cords, with an eye at one extremity and the **Gaskets**, other usually tapered off. Used in various ways in the service and management of heavy ordnance, to keep any weight suspended, or take the strain off a rope.

The superior part of the parapet of the covered way, **Glacia**, forming a gentle slope towards the country.

A rope used to support a derrick, sheers, or any heavy **Guy** body while hoisting or lowering.

Four slightly-twisted yarns of coarse hemp, twisted **Hambro'** together, forming three strands, which are also twisted **line** together.

A wooden lever, 6 or 7 feet long, and $3\frac{1}{2}$ inches square **Handspike**, at the larger end, which is generally bevelled off. Used **Common** for moving ordnance, carriages, &c.

Tanned hides are used to cover the floors of magazines, **Hides**, in order to diminish risk of accident from grit or sand.

Raw hides are used to cover the revetments of embrasures in field works. The hides are doubled, the hair inwards, two to each cheek, and fixed by pickets driven through them.

Projections formed on each extremity of the brackets of **Horns**, mortar beds for handspikes to take a purchase against in traversing.

A thin narrow ring of wrought-iron fitted on the breech-screw of a B.L. gun, with a raised line of brass on it, **Indicator** which shows by its coincidence with a similar line on the **ring** top end of the breech-screw, whether the vent is properly screwed up.

A handspike 4 or 5 feet long, bevelled at the point **Iron-shod** and shod with iron. Used for traversing platforms. **handspike**.

- Junk.** Old pieces of cable, cordage, &c. Used for making oakum, gaskets, selvages, wads, &c.
- Kamptuli-con.** A species of felt used for the washers placed above the bullets and rosin in Shrapnel shells, &c.
- Keckle.** To twine a small rope round a cable or bolt rope, to prevent injury from friction.
- Kink.** The twist or curl of a rope when twisted too hard, or drawn hastily out of the coil.
- Kit, Soldiers.** Comprises all articles of clothing, necessities or equipment (issued to him as a free issue, or on repayment), which he is required by regulation to have in his possession.
- Kit plaster.** Stout canvas prepared with pitch, tallow, beeswax, and rosin, for closing fuze holes, &c.
- Lacquer.** A composition used to paint the interior of shells, in order to protect the bursting charges against risk of premature explosion. Both black and red lacquer were used, but the former has now been discontinued.
- Lands.** The spaces between the grooves in a rifled gun.
- Lanyard.** A line with a hook at one end for firing friction tubes.
- Lapping.** The process of making any hard surface smooth and accurate by the application of polishing powders—performed both before and after rifling a gun, to remove burrs from the edges of the grooves.
- Leading part of a Tackle.** That part which is hauled on.
- Lever.** A bar of wood or iron turning on a fulcrum, used for moving ordnance, carriages, &c. There are three *orders* of levers. (1.) When the fulcrum is between the weight and the power applied to move it, as in elevating a gun. (2.) When the weight is between the power and the fulcrum, as in running up a carriage. The 3rd order is not applicable to artillery purposes.
- Limber.** That part of an artillery carriage to which the horses are attached, and the gun trail or wagon body is connected, in such a manner as to be readily detached.

The edge of the groove against which the studs of a **Loading** projectile bear in loading. **edge.**

A composition made of equal parts of tallow and bees- **Luting.**
wax. Used on the lids of metal-lined and metal cartridge
cases to exclude the air.

To feign sickness or incapacity for duty. **Malingering.**

A two strand line, either white or tarred. **Marline.**

A tapered iron pin by means of which openings are **Marline**
made between the strands of a rope when splicing, &c., **spike.**
and lashings, seizings, &c., are strained tight.

The power or force of moving bodies, and is the product **Momentum**
of the mass into the velocity.

To *seize* the point and back of a hook with spun yarn, **Mouse.**
in order to prevent its disengaging itself from anything to
which it may be hooked.

To stop ropes with a gasket, or with several turns of **Nip.**
spun yarn round each and the ends made fast.

The N.C.O. in charge of a sub-division, *i.e.* a gun and " **Number**
wagon of a battery. **1."**

Applied to projectiles which have heads shaped like the **Ogival**
Gothic arch. **headed.**

Triangular prisms of wood, about 10 ft. long and 6 in. **Palisades.**
on each side of triangle, pointed at top, and fixed vertically
in the ground. Used in field fortification.

To put round a rope canvas well daubed with tar and **Parcel.**
bound with spun yarn to protect it from chafing.

A short bar of iron or wood used with various mechanical **Pawl.**
appliances for artillery service—*e. g.* In the sling wagon
iron pawls are pivoted to each bracket, to work in the
teeth of the ratchet plate, and prevent the windlass turning
back. Iron pawls are also pivoted between the socket
rings, having hooked ends which catch the teeth, and so
enable the levers to bring the windlass round. **Wooden**

pawls are passed through mortise holes in the windlass to secure it when travelling with a weight on it.

Pedestals. For the support of the stool-beds of carriages when the elevating screws are removed. Made of elm.

Perch. That part of an artillery wagon body, which connects it with the limber, by means of a nose plate with an eye for attachment to the limber hook.

Piasaba brushes. Gun brushes for field M.L.R. guns. There are two Marks; Mark I. consists of an elm head with Piasaba grass glued into it, fixed upon a stave; head cylindrical and same length as sponge head. Mark II. is similar, except that it is stronger and has the tufts of grass running spirally instead of longitudinally.

Pivot. The flank man on whom, or the point on which a wheel is made. In column, that flank to which the constituent parts of the column are working.

Pontoon. A flat-bottomed boat constructed from wood, covered with canvas. Used either as a boat, or several of them boarded over, to form a bridge.

Preventer. An additional rope, employed when necessary to support or answer the purpose of another when injured or subjected to too great a strain.

A rope hooked into an eye-plate on a sliding carriage, and taken twice round the *bollard* on the platform, the end being manned by one of the detachment, to control the running up of the carriage.

Prolonge. A rope with an iron eye at one end, a hook at the other, and a link in the middle. Used to connect the trail of a field gun with the limber hook when it is desirable to retire short distances in action without limbering up.

Purchase. To take a *purchase* is to place a lever or handspike in such a position, under any body to be moved, so as to be able to use the lever with the desired effect.

A wedge-shaped piece of wood bevelled on one side, **Quoin**, placed under the breech of a gun to elevate or depress it.

A sloping roadway cut in the interior slope of the **Ramp**, rampart to form a communication to the terreplein.

The daily allowance of bread, meat, &c., issued by **Rations**. Government to a soldier, or the forage issued to a horse.

The *free ration* consists of 1 lb. of bread and $\frac{3}{4}$ lb. of meat.

To pass a rope through a block. **Reeve**.

The first reinforce is that part of a S.B. gun between **Reinforce**, the base ring on the breech and the first reinforce ring (which is about $\frac{2}{3}$ the distance from the base ring to the trunnions).

The second reinforce extends from the first reinforce ring to the second reinforce ring in front of the trunnions, where the chase begins.

The masonry which retains the earth of the rampart on **Revetment** its exterior slope.

A rope is said to *ride* when one part overlaps another **Ride**, on a capstan, windlass, &c.

Iron rings (with handles) of two sizes, for each nature of **Ring gauge** projectile; the high gauge should pass over the shot, the low should not.

A cylindrical piece of wood (sabicu), 14" long, used for **Roller**, shifting a siege gun from the firing to the travelling holes, and *vice versa*.

Wooden rollers of various sizes are used for mounting and shifting ordnance.

A wooden handspike with metal trucks, hook, pawl, **Roller** and fall, for running up carriages on traversing platforms. **handspike**.

Also a wooden handspike with wood trucks and a projecting knob at the end for running up rear-chock carriages.

To move a gun in the direction of its length, by means **Row**, of using handspikes with a rowing motion. Applied on

skids under the gun as levers of the first order, and at the same time hauling on, a drag rope fastened round the muzzle or breech, according to the desired direction.

Sabicu.

A wood used for making the block, on a field service ammunition wagon, for spare wheel, blocks of sliding and rear-chock carriages, and sides of naval slides. It is heavy, close grained, durable, and little liable to shrink.

**Saddle for
B.L. Guns.**

A flat plate on top of the breech-coil of the 40-pr., and 7-in. B.L. screw guns, placed in rear of the slot for vent-piece, to receive the latter when lifted out of the slot.

**Salient
angle.**

An angle projecting outwards. In a fortification it should be as large as possible, and never less than 60°.

Scantling.

The breadth and thickness of a piece of timber. A term generally applied to small timbers.

Scotches.

Right-angled triangular wedges of wood, generally elm, used for placing in front and rear of any weight to prevent it from moving.

To scotch is to wedge up a wheel, gun, roller, &c., so as to prevent their moving; this is done with scotches, handspikes, &c.

Seizing.

To seize a rope is to connect two parts together with lashing.

Selvagee.

Is formed of turns of spun yarn turned into a circular form and bound together. Used to attach the hook of a tackle; the selvagee being passed round the object, and the tackle hooked to the bights.

Serve a rope.

Is to wind line or small rope round it by means of a serving mallet, to prevent it from being chafed.

Shackle.

In B.L. screw guns the shackles are the handles of the vent-pieces. The vent-pieces of the 7-in. and 40-pr. have two, and those of the 20-pr. and smaller natures, one.

Of harness, the shackle is a band of leather attached to the end of the heel rope, and when the horse is picketed it is buttoned round one of his hind legs below the fetlock;

it is sometimes lined with felt or a piece of numnah, &c., to prevent galling.

Consist of two heavy spars of wood lashed together at **Sheers** top, and steadied by guy ropes made fast to pickets or some other convenient objects. They are used to raise heavy ordnance, weights, &c., and there are three natures, viz., ordinary sheers, lever sheers, and gyn sheers.

Rectangular pieces of wood (oak or fir) of various dimensions, used for placing under guns when moving them.

To slew the trunnions of a gun is to turn the gun on **Slew** its axis, so as to bring the trunnions into any fixed position. To slew a gun end for end is to turn it round, not allowing it to revolve on its longer axis.

A block, one side of which opens so that a rope can be **Snatch-** put into it at any time. It is closed by means of a hook **block** and staple.

The spanner is a bar of iron with a fixed and a movable **Spanner** claw for use as a wrench. The movable claw can be set at any distance from the fixed by means of a thumb-screw.

To splice a rope is to join the two ends together, or to **Splice** unite the end to any part thereof by interweaving the strands in a regular manner.

When speaking of tackles, the fixed end of the fall is **Standing** called the standing end.

A wooden support for the quoin and breech, placed **Stool-bed** above the elevating screw.

Is a gasket or short piece of rope used to keep any **Stopper** weight suspended, or to take the strain off a rope, one end being always attached to some fixed object. It must be stronger than the rope it has to hold.

Is a fid of wood made to fit the bore of a piece of ord- **Tampeon** nance accurately, and of sufficient length to remain in the bore when the axis is horizontal. It is generally covered with flannel kept oiled to preserve the bore from rust.

- Terreplein.** In fortification is the upper part of the rampart which remains after having constructed the parapet.
- Toggel.** A small wooden pin, tapering from the centre towards each end. Used for fixing tackles instead of a hook.
- Trail.** In a field carriage is that part of the carriage which rests on the ground when unlimbered, and which is hooked on to the pintail of the limber when limbered up.
- Traverse.** In fortification is a parapet of earth thrown up to protect entrances into works from fire; in the covered way of a fortress, traverses cross the breadth of it at the salient, and re-entering places of arms, &c., to protect troops from enfilade fire. They are also put in a battery between the guns to guard them from enfilade fire.
- Traversing.** Is moving the muzzle of a gun to the right or left when laying. It is done by means of handspikes applied to the trail, rear of carriage, or rear of traversing platform, as the case may be, and in B.L. guns by traversing screw.
- Trucks.** Are small wheels of wood or iron on garrison carriages, and on front and rear of traversing platforms, &c.
- Truck lever.** Levers used in running up guns on traversing platforms, they have a small truck or wheel on which the lever is supported, while immediately above the wheel is an iron point which is placed into an eyebolt on the rear of the carriage. When the lever is borne down, the weight of the carriage is taken off, and it runs up assisted by the trucks on the levers.
- Unbend.** To cast off, unlash, or loose a rope.
- Unlimber.** To detach the gun carriage or wagon body from the limber.
- Unreeve.** To detach a rope from its block.
- Uphirs.** Long straight spars: by throwing two uphirs across a ditch, field guns and carriages can be passed over.
- Wadmiltilt.** A sort of rug or blanket used for the floors of maga-

zines, in order to diminish risk of accident from grit or sand.

Used also to cover ammunition conveyed in wagons.

Rings of iron placed between the nave of a wheel and **Washers**. the linch-pin to prevent the nave working against the linch-pin. They are either *plain* or *drag*, the latter having a loop to take the hook of a drag-rope.

A triangular prism of wood or metal.

Wedge.

The crank handle by which the axis of a machine is **Winch**. turned.

The divisions or brigades on the right and left of the **Wings**. centre of an army.

Projections on a projectile; by the action of the gas from the charge, or the air on the wings, a rotatory motion is imparted to the projectile.

A small single tackle. A *whip-upon-whip*, consists of **Whip**. two movable blocks, one of which is applied to and acts upon the running end of the fall of the other.

To wind a piece of rope round a spar, &c.

Woold.

A stick about $2\frac{1}{2}$ feet long. Used to haul taut a lashing **Woolder**. rope.

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A P P E N D I X I.

TABLES OF SERVICE ORDNANCE AND FUZES.



CHAR.				SHOT.				NATURE OF ORDNANCE.
Battering.		Full, or service.	Shrapnel, Pistol, F.G. or R.F.G.	Case.	Common, solid.	Fallsch.		
oz.	lbs. oz.						lbs.	
...	...	11 0	...	69 0	...	...	Breech-loading.	
...	...	10 0	...	69 0	...	...		
...	...	5 0	0 3	31 8	40 13½	...		
...	...	5 0	0 3	31 8	40 13½	...		
...	...	2 8	...	15 0	20 9½	...		
...	...	2 8	...	15 0	20 9½	...		
...	...	2 8	...	15 0	20 9½	...		
...	...	1 8	0 0¾	11 8	11 7	...		
...	...	1 2	0 0¾	9 0	8 13	...		
...	...	0 12	...	4 4	6 2	...		
...	...	9 0	0 5	48 0	...	...		
...	...	5 0	0 3	31 0	...	...		
...	...	85 gr. R.	...	...	480 grs.	...		
...	...	1 12	0 0¾	9 13½	...	...		
...	...	0 12	0 0¾	6 4	...	...		
...	...	0 8	0 0¾	...	...	...		
...	...	10 0	0 9	50 8½	...	...		
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...	...	8 0	0 9	50 8½	...	...		
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0	67 0	50 0	1 15	246 0	...	...		
0	70 0	50 0	...	200 0	...	...		
0	60 0	40 0	1 9	143 0	...	...		
...	43 0	30 0	1 5	107 0	...	...		
...	30 0	20 0	1 0	74 0	...	...		
...	22 0	14 0	0 12	69 0	...	...		
...	...	14 0	0 12	69 0	...	...		
...	...	8 0	0 9	50 8½	...	...		
...	...	7 0	0 5	38 6	...	...		
...	...	4 0	0 3	24 4	...	...		
...	...	3 0	...	15 3	...	...		
...	...	1 12	0 0¾	9 13½	...	...		
...	...	1 8	0 0¾	9 13½	...	...		
...	...	1 12	0 0¾	9 13½	...	...		
...	...	0 6	0 0¾	6 4	...	...		
...	...	10 12	0 0¾	6 4	...	...		
...	...	10 lb, 5 lb	...	74 0	...	...		
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5 sec., fired with charge up to 80-pr. inclusive (7-11) account of a slight difference in sighting for L.S. and S.S. For sea service only. Velocity being 7 $\frac{1}{2}$ lbs., 4 lbs.

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APPENDIX II.

FOR M.S. NOTES.

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